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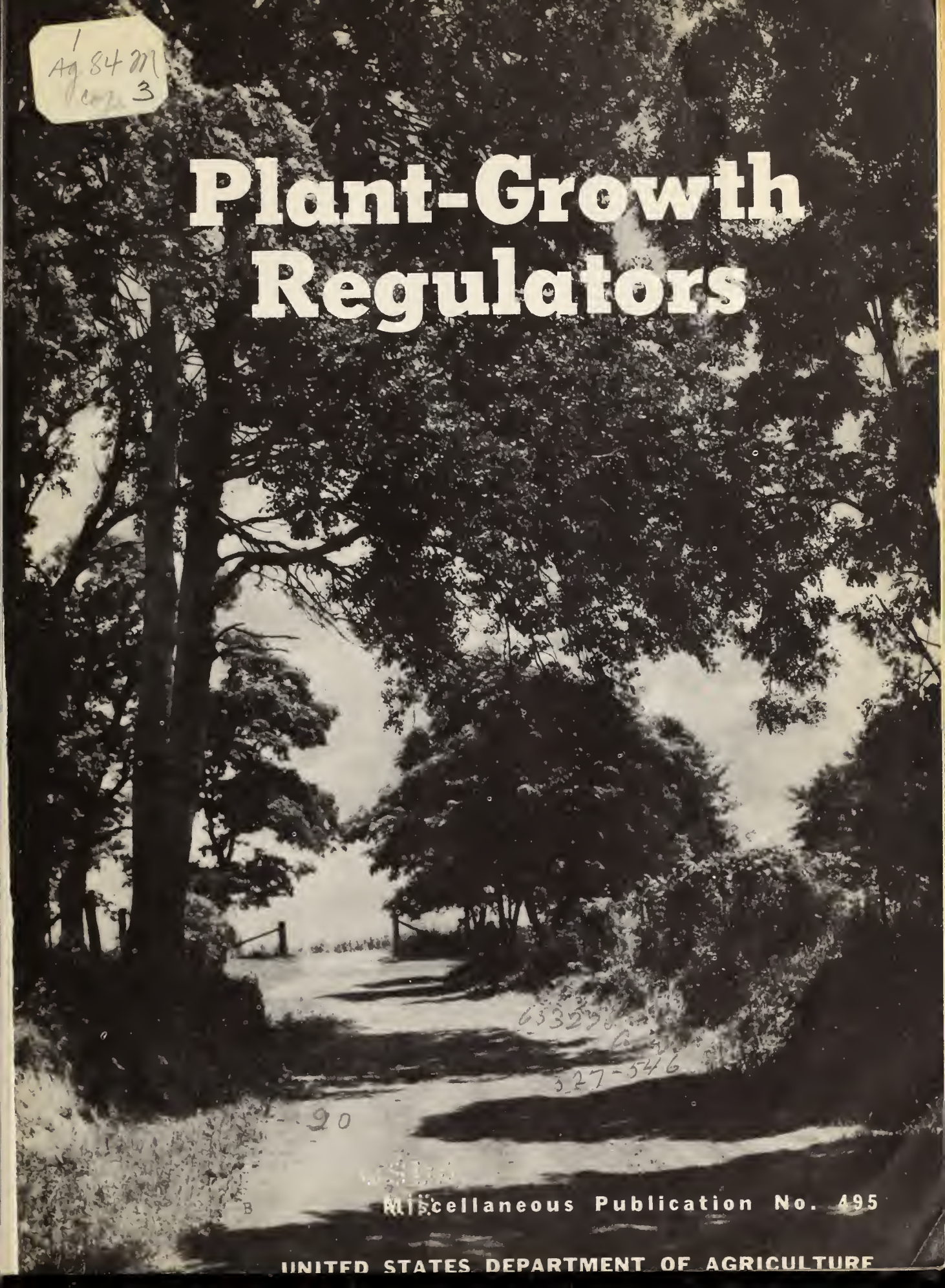

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Plant-Growth Regulators

532436

By John W. Mitchell and Ruby R. Rice
Bureau of Plant Industry

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This publication is a compilation of results of work done by the Bureau of Plant Industry, United States Department of Agriculture, together with results of work done independently by many investigators associated with various institutions and governmental agencies. The publication was prepared under an allotment from the Special Research Fund authorized by Title I of the Bankhead-Jones Act of June 29, 1935.

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Growth Regulators and Plants

For many years agriculturists have used different substances such as lime, potash, copper, and arsenic as fertilizers, fungicides, and insecticides. More recently, however, another group of substances has become of importance agriculturally. These are known as growth-regulating substances since, when applied in various ways to plants, they inhibit, greatly increase, or alter in various ways the growth and development of plants.

Experiments have shown that the propagation of some crop plants, such as grapes and citrus, and the yields of others, such as apples, can be improved by the application of growth-regulating substances. Research in this field, therefore, has an important bearing on the Nation's effort to produce more and better foods, and it is timely to summarize our present knowledge of the practical applications of these substances so that they may be more effectively used in agriculture.

Soybeans grow taller when hormone from corn pollen is rubbed on the stem (left).

Attention was first directed toward this group of chemicals when it was found that a substance known as indoleacetic acid had plant growth-regulating properties. This discovery, which was at the time only remotely related to practical agriculture, suggested to scientists that there were many other chemically related substances capable of regulating plant growth. Many of these were readily available at that time, since methods by which they could be made were already known. Thus a new use was discovered for a group of substances already on hand, namely, that they could aid in our attempts to regulate the growth of plants so as to better suit them to our needs. Efforts to adapt the use of these substances to agricultural practice have met with considerable success in connection with plant propagation and fruit production.

What Are Growth-Regulating Substances and Plant Hormones?

The growth of stems, leaves, roots, and buds is thought to be controlled partly by growth-regulating substances made within the plant and distributed throughout the various organs. These substances are not easily separated from the plant since they occur in very small amounts. However, it is not difficult to demonstrate that they are present in certain plant parts. For instance, some substances soaked out of corn pollen and then rubbed on a young stem stimulated the treated part to grow in length.

Naturally occurring substances which serve to regulate plant growth are termed "plant hormones." They have been obtained from plants only in impure form or in amounts so small that it has not yet been possible to apply them to crop plants to test their effects from the standpoint of agricultural practice.

The growth-regulating chemicals sold commercially for treating seeds and plants are all synthetically made and are not known to occur widely in green plants. More than 50 such compounds have been reported to have growth-regulating properties. Among the most useful are several weak acids, including indoleacetic, indolebutyric, indolepropionic, naphthaleneacetic, and phenylacetic acids, and naphthalene acetamide. These substances, usually sold in the form of white powders or colorless crystals, can be obtained from chemical-supply houses.

How to Prepare and Apply Growth-Regulating Substances

Only minute amounts of these chemicals are needed to produce noticeable effects when applied to growing roots, stems, leaves, or fruits. In practical use the substance is greatly diluted with an appropriate carrier, such as water, talc dust, oils, fats, or various forms of plant residues, before it is applied to the plant. The strength of such mixtures is often expressed as parts of the growth-regulating substance per million parts of the carrier, abbreviated as p.p.m. Some are also effective when vaporized by means of heat and applied to the plant in the form of a gas. Methods of making such mixtures follow.

Water Solution

Some of the chemicals more commonly used, including indoleacetic, indolebutyric, and naphthaleneacetic acids, are relatively insoluble directly in water. To make a water solution of these it is desirable first to dissolve the required amount of the substance in a small volume of grain alcohol (half a teaspoonful for most purposes), and then to add the alcoholic solution to the required amount of water. Naphthalene acetamide can be dissolved in propyl alcohol and then added to water; the alcohol may be boiled off from the final solution if desired. These solutions may be applied to the plant by watering the soil or medium in which it is growing, by spraying them onto the plant, or by soaking various parts of the plant, such as seeds, leaves, stems, or roots, in them.

Paste

In some instances it is desirable to mix the growth-regulating chemical with fat to form a paste, which can be applied to any part of the plant. Strengths of 1 to 2

percent by weight are most useful. The desired amount of chemical is added to a weighed amount of lanolin, the container is heated gently until the lanolin is melted, and then the mixture is stirred so as to disperse evenly the growth-regulating substance as the lanolin hardens. Still another method consists of first dissolving the chemical in water or alcohol, then adding the solution to lanolin, and finally evaporating off the water or alcohol if desired.

Dust

Talc and other finely ground inert materials are other carriers into which growth-regulating substances can be readily dispersed. A simple method consists of dissolving the required amount of chemical in grain alcohol; the solution is added to a measured quantity of talc to form a paste; and this mixture is then dried with occasional stirring, so as to leave the chemical evenly mixed in the talc. Such dusts may be readily applied to seeds, cuttings, or roots of plants.

Emulsion

An emulsion of lanolin and water can be made by adding the following substances:

Growth-regulating substance . .	0.3 milligram
Lanolin	5.0 grams
Soap (flakes)	5.0 grams
Agar (arbitrary)	0.25 gram
Water	100.0 milliliters (approximately 1 cup)

The amount of growth substance used depends upon the purpose for which the spray is intended, a safe and effective range being between 50 and 300 milligrams per liter (quart) of emulsion. Low concentrations are often effective when used for treating blossoms or fruit, but stronger mixtures are most suitable for treating cuttings. The lanolin is melted and mixed thoroughly with the growth regulator to form a paste. The agar is dispersed in a cupful of hot water, and the soap chips are added. The mixture is heated and stirred or shaken thoroughly to form a smooth emulsion. Enough water is then added to make a final volume of 1 liter for spraying. Other emulsifiers may be substituted for soap; in this case the amount required to give a stable emulsion depends upon the specific emulsifier used.

Vapor

Another method, particularly useful for treating greenhouse plants, consists of fumigating the house with a growth-regulating substance. The majority of these substances can be vaporized easily by placing them on a glass plate on an electric hot plate; the glass is heated and then a measured quantity of powder is placed on the hot glass. Only a few minutes is required to vaporize the powder, provided the glass is sufficiently hot.

By means of these various methods of treatment it is feasible to apply growth-regulating substances to entire plants or to their different parts under a wide variety of conditions, depending upon convenience.

Growth-Regulating Substances Aid in the Rooting of Cuttings

Cuttings from most species of plants have a tendency to produce roots, although their ability to do so varies, depending upon the kind of plant, the type of wood used, the season when the cuttings are made, and the conditions under which they are grown afterwards. This tendency to root is often expressed more readily when the cuttings are soaked or dusted with growth-regulating substances before planting. Root growth on a cutting results from a series of well-defined steps. The first of these is the movement of food materials toward the basal end. Some of the cells near the base of the cutting begin to divide and increase in size and number. Gradually many of these cells organize into the beginnings of new roots, which, as development proceeds, aid in nourishing the cutting.

Growth-regulating substances, when applied to certain kinds of cuttings, increase the rate of cell division. Thus, when properly used, these substances lessen the time required to produce a plant with an adequate root system, increase the number of roots per cutting and the percentage of cuttings that root, and extend the season during which cuttings can be successfully made. Of these effects, the most commonly observed are an increase in the number of roots per cutting and a decrease in the time required for the cutting to produce them. The fact that a treated cutting produces many more roots than an untreated one is not always an advantage, since the fewer roots of the untreated cutting are sometimes adequate for the subsequent growth and development of the plant. Furthermore, the abundant production of roots sometimes temporarily delays top growth and in this way extends the time required to establish a vigorously growing plant.

Chemically induced rooting

Paste applied | Six days later | Ten days later

It is desirable that cuttings establish roots quickly, not only because time and space are saved, but also because vigorously growing roots are more resistant to disease than less vigorously growing ones, and thus there is a better chance to develop suitable plants.

Of particular value is the effect of growth-regulating substances on difficult-to-root cuttings. In some instances cuttings failed to root when left untreated, but rooted 100 percent when treated. In general the use of root-inducing substances has proved of considerable commercial value. Although a few species fail to respond or are injured, the rooting of by far the majority of species tested has shown improvement as the result of properly applied treatments.

In order to indicate the degree to which cuttings of different species might be expected to respond to treatment with different growth substances, five tables have been prepared. (See p. 14.) These include information gathered by numerous experimenters who worked under widely different conditions. The tables may serve as a guide in treating cuttings, but occasionally somewhat different results may be obtained, since conditions under which cuttings are grown vary with different users.

Growth regulators are easily applied to a few cuttings or to many.

How to Treat Cuttings

Cuttings from herbaceous plants generally root more readily, either with or without treatment, than do those from shrubs or trees. A relatively strong treatment is usually recommended for woody cuttings, and this can be accomplished either by increasing the length of time of soaking when a solution is used or by increasing the concentration of the growth-regulating substance in the case of either solution or dust treatments.

Soaking

A suitable method of treatment is to allow the lower ends of the cuttings to stand in a water solution of the root-inducing substance until a sufficient amount has been absorbed to

Growth regulators improve the rooting of currant cuttings. (Photograph by courtesy of the Royal Horticultural Society of London.)

stimulate root growth. Either metal or glass containers may be used, and their size and shape should be varied so as to suit best the type and number of cuttings concerned.

In general herbaceous cuttings should be allowed to stand in a relatively weak solution for a relatively short time, while cuttings from woody shrubs and trees are often treated with stronger solutions for a longer period of time. (See tables, pp. 14-64.)

Dusting

Another method of treatment consists of wetting the basal half inch of the cutting and then dipping this portion into talc containing the root-inducing substance. Talc alone sometimes stimulates the rooting of cuttings of some species, but in most cases the addition of a growth regulator to the talc stimulates their rooting still more. Dust treatments are easily applied to individual cuttings and are often as effective as the soaking method, provided a talc mixture having the proper concentration of growth-regulating chemical is used. Since different species vary as to the amount of growth-regulating substance required to increase rooting, it is necessary to have several strengths of these dusts on hand. There is little danger of the powders' deteriorating, even though they are left uncovered for an extended period. Some cuttings fail to produce vigorously growing roots after having been soaked in water. In such cases it may be advantageous to use the dusting instead of the soaking method.

Spraying

Improved rooting has also been obtained by spraying the root-inducing substance on the cuttings after they have been planted in the rooting frame. Emulsion sprays containing 100 to 300 milligrams of the chemical per liter are most suitable. This method makes possible the treating of large numbers of cuttings without special handling.

Ringing

It is sometimes advantageous to treat the attached stems of plants which are especially difficult to root with lanolin paste containing 1 to 2 percent of a growth-

regulating substance, applied as a ring around the stem and close to a node. The cutting should be taken four to eight days after the attached branch has been treated, and cut just below the lanolin ring so as to include the paste-covered portion as the basal end of the cutting.

Re-treatment

Re-treatment of cuttings which have been previously treated by soaking but have failed to root has sometimes proved of advantage. In some instances more cuttings rooted when the second treatment was applied several months after the first one.

Lily scales produce more roots when treated with growth-regulating substances (bottom row).

Use of commercial preparations

Several proprietary preparations for treating cuttings are on the market, and these should be used according to the manufacturers' directions.

Substitute and supplemental treatments

Some substances other than those commonly listed as growth regulators also increase the rooting of cuttings under certain conditions. Potassium permanganate is among these, and its use after the cuttings are planted improves the rooting of some species. The chemical may be applied as a solution (1 pound to 15 gallons of water) at the rate of 2 quarts per square foot over the rooting medium. The soaking of cuttings for 24 hours before planting, in a solution containing ½ to 1 ounce of potassium permanganate per 3 to 5 gallons of water also resulted in a higher percentage of rooted cuttings. One to five percent of common table sugar, added to a water solution of a root-inducing substance, sometimes stimulates rooting. Vitamin B_1, when added to the rooting medium in which cuttings have been set, has likewise increased rooting, especially in the case of orchids. About 1 teaspoonful of a weak solution (1 p.p.m.) should be poured around the base of each cutting. The last two treatments have generally been used to supplement the usual soaking or dusting treatments with growth-regulating substances. The importance of sugar and vitamin B_1 in connection with rooting cuttings seems to lie mainly in the fact that they sometimes aid in the rooting of cuttings that are deficient in these substances.

Control of Preharvest Fruit Drop

When applied in the form of a spray or paste, growth-regulating substances may sometimes delay the falling of leaves, flowers, or fruits. The premature dropping of fruit often results in serious economic losses. Fruit grown and ripened under favorable conditions of moisture and nutrition usually remains firmly attached to the tree until the ripening process is well advanced.

Generally a ripe fruit is only weakly attached to the tree until dislodged by some mechanical means. Under conditions of insufficient moisture or improper thinning or fertilization in an orchard, this weakening of the stem attachment may come about prematurely, before the fruit has reached full size, full color, or ripeness. To avoid the risk of such preharvest drop, it is often necessary to remove the fruit earlier than is desirable for best color and quality.

In 1939 F. E. Gardner, P. C. Marth, and L. P. Batjer, of the U. S. Bureau of Plant Industry, tested the effectiveness of a number of different growth-regulating substances in preventing preharvest drop of apples. Naphthalene acetamide and different forms of naphthaleneacetic acid were found to be very effective in this respect. Several proprietary preparations were soon on the market, and during the following season between 20 and 30 thousand acres of commercial orchards were sprayed for the purpose of preventing fruit drop. These early field trials were successful, and in 1941 a greatly increased acreage was sprayed commercially in both the United States and Canada.

Preharvest apple drop can be reduced

Profitable control depends mainly on the care and skill with which the spray is applied. In its use it is necessary to take into account several factors. For instance, the effect of treatment lasts only 10 to 12 days on McIntosh apple, but it may last for as long as three weeks on other varieties. It is therefore very important

that the spray be applied so that the effective period covers the time when most serious drop would be experienced. A spray that has been applied too early to be effective may be followed by a second spray more appropriately timed so that its effectiveness covers the desired period, but repeated spraying is otherwise unnecessary. Delicious, Stayman Winesap, and Winesap varieties should not be sprayed earlier than 14 to 17 days before the harvest period. It is important that the spray be applied to the stem of the apple; therefore, thorough coverage should be obtained. Spray solutions containing approximately 0.0005 to 0.001 percent of growth-regulating chemicals are most commonly used. About 1 gallon of spray solution per bushel of apples is usually required. When these precautions are taken, the use of growth-regulating substances will generally retard the preharvest drop of apples.

(right) by spraying with growth-regulators.

Transplanting

Even under the best conditions the growth of a plant is generally checked by transplanting, and under severe conditions plants may even be lost. The use of growth-regulating substances has been suggested as a possible means of decreasing these losses by hastening renewed root growth, in that way increasing the number of survivals and decreasing the time required for transplants to recover. Although the use of growth-regulating substances in this way has been of benefit under certain conditions, they have not been extensively tried, and their value in this respect has not yet been clearly demonstrated. Methods that have been used include watering with a solution after transplanting,

The following tabulation illustrates the widely different results that have been reported:

Scientific name	*Common name*	*Best treatment*	*Results*
Acer sp.	HARD MAPLE	Soaking roots in 25 p.p.m. indolebutyric acid.	Much improved root growth. (80) §
Carya pecan	PECAN	Inserting toothpicks carrying 4 milligrams indolebutyric acid each into holes drilled in severed roots.	Improved root growth; roots can be cut back farther; older trees can be transplanted. (64, 68)
Cornus florida	FLOWERING DOGWOOD	Soaking roots in 2 p.p.m. naphthaleneacetic acid.	Increased growth. (2)
Cotoneaster divaricata	SPREADING COTONEASTER	Soaking roots in 20 p.p.m. indolebutyric acid 18 hours.	Increased root growth. (9)
Juglans nigra	BLACK WALNUT	Soaking roots 48 hours in 25 p.p.m. indolebutyric acid.	Much improved root growth. (8)
Juniperus virginiana	EASTERN REDCEDAR	3 weekly waterings with Transplantone No. 3, ¼ teaspoon per gallon of water.	Increased survival and growth. (75)
Lonicera fragrantissima	WINTER HONEYSUCKLE	Dusting roots with 1,000 p.p.m. nicotinic acid in talc.	Increased top growth. (75)
Lycopersicum esculentum	TOMATO	Weekly waterings with Transplantone No. 3, 1 teaspoon per gallon of water.	Increased early growth. (75)
Do.	do.	Using a dilute starter solution of fertilizers, with or without vitamin B complex.	Starter solution effective as supplement to regular fertilizers; vitamin B of no advantage. (65)
Malus sieboldi arborescens	TORINGO CRABAPPLE	Dusting roots with 200 p.p.m. indolebutyric acid; Transplantone No. 1.	Increased top growth and root growth where main roots cut. (75)
Picea glauca (P. canadensis)	WHITE SPRUCE	3 weekly waterings with Transplantone No. 3, ¼ teaspoon per gallon of water.	No favorable results. (75)
Pinus strobus	EASTERN WHITE PINE	Soaking roots in 25-40 p.p.m. indolebutyric acid 48 hours.	No favorable results. (80)
Prunus persica	PEACH		
	Elberta	Soaking roots in 25 p.p.m. indolebutyric acid 48 hours.	Much improved root growth. (80)
Quercus palustris	PIN OAK	Do.	Do.
Q. velutina	BLACK OAK	Do.	Do.
Quercus sp.	RED OAK	Do.	Do.
Thuja sp.	AMERICAN ARBORVITAE	Do.	Do.
Tsuga canadensis	CANADIAN HEMLOCK	Soaking roots in 0.2 p.p.m. indolebutyric acid 36 hours.	Reduced mortality. (2)
Ulmus americana	AMERICAN ELM	Soaking roots in 25 p.p.m. indolebutyric acid 48 hours.	Much improved root growth. (80)
Viburnum dilatatum	LINDEN VIBURNUM	Soaking roots in 20 p.p.m. indolebutyric acid 18 hours.	Increased root growth. (9)
Vitis sp.	GRAPEVINE	Soaking roots in 10 and 100 p.p.m. indolebutyric acid.	Improved root growth. (53)

§ Numbers in parentheses refer to literature citations, pp. 65-68.

soaking the bare roots in a solution at the time of transplanting, and dusting the bare roots with talc dust that contains one of these substances. A method successfully used on pecan trees consists of inserting ordinary round toothpicks, previously impregnated with a root-inducing substance, into holes near the cut ends of any large roots severed in the process of transplanting. The toothpicks can be prepared for use in this way by soaking them for 24 hours in a concentrated alcoholic solution of indolebutyric acid (1 gram to about 4 teaspoonfuls). This method may be suitable for the transplanting of relatively large trees or shrubs, particularly those that tend to develop new roots slowly after transplanting.

Possible Future Uses for Growth Regulators

Although growth regulators have already proved of value in connection with plant propagation and fruit production, their usefulness in general agricultural practice has not yet been fully realized. Plant growth has been controlled experimentally with these substances in a number of other ways which may eventually prove of value to agriculture. Some of those which already appear promising are mentioned.

A possibility of meatier tomatoes with smaller seeds (bottom row).

Seedless holly berries grown from unpollinated flowers with the aid of growth regulators.

The development of some kinds of fruit has been controlled experimentally through the use of growth-regulating substances. In this way the size and number of seeds per fruit have been reduced and in some instances the quality of the fruit improved.

Prevention of lodging - a possibility. Treated flax plants on right.

Unpollinated flowers sprayed with growth-regulating substances have been made to develop into fruit of usual size and appearance but without seeds. To produce such effects the flowers of various kinds of plants, including squash, watermelon, eggplant, tomato, and pepper, have been treated, and the fruit was allowed to grow to maturity. Greenhouse tomatoes with small seeds and of superior quality have been produced experimentally by spraying the flowers at the time of pollination with indolebutyric acid in lanolin emulsion. A similar effect can be produced by fumigating the plants with one of several growth regulators. Neither method has been thoroughly tested in the commercial production of greenhouse tomatoes, where they would seem to be of special value.

Another promising response which can be brought about through the use of growth-regulating substances is stiffening of the stems of plants which have a tendency to lodge and are therefore often difficult to harvest. Naphthalene acetamide sprayed on succulent plants causes the stems to grow stiff and woody and in this way lessens their tendency to lodge. This response has been observed only experimentally, and a practical application of the effect has not yet been developed.

Generally, it is desirable that plants, tubers, or bulbs should not sprout when kept in storage. The growth of leaf buds of some plants has been inhibited experimentally by spraying them with a solution containing a growth-regulating substance or by treating them with the substance in the gaseous form. With further experimen-

tation this may develop into a practical means whereby stored plants, bulbs, and tubers can be kept from sprouting in storage.

Recently attention has been directed toward the effect of treating seeds with growth regulators. The seeds are generally treated by soaking in a solution or dusting with talc or flour containing these substances. Several commercial preparations to be used for this purpose are on the market. Increased yields are reported to have been obtained from the use of seed treatments in certain localities, but in other areas such treatments have been of no practical value.

Thus, from a practical standpoint, the use of plant growth-regulating substances has served to improve methods of agricultural practice, but they represent a relatively new means of controlling the growth and development of crop plants - a tool, the full usefulness of which is not yet understood. Claims as to how their use increases yields have sometimes been extravagant. But the fact still remains that the growth and development of plants can be controlled in a number of ways by means of these substances and that through continued and careful study their usefulness will be extended so as to better fulfill the needs of the plant grower.

Rest period of peach buds prolonged by means of growth regulators (right).

THE USE OF GROWTH-REGULATING CHEMICALS IN THE ROOTING OF CUTTINGS

Tables 1 to 5 are compilations of results obtained by experimenters who have tested the effects of various chemicals and commercial preparations on root production by cuttings. The results have been evaluated on the basis of size and number of roots and of the time required for the cuttings to form adequate root systems. The response of cuttings to growth-regulating substances depends partly upon the species, rooting medium, type of wood used, and the season. Therefore, results somewhat different from those recorded here might be obtained.

The commercial preparations mentioned can usually be obtained from seed dealers; growth-regulating substances mentioned can be obtained from chemical supply houses. To prepare a water solution containing approximately 1 part per million (1 p.p.m.) of a growth-regulating substance, use the amount of powder which would remain mounded upon the flat end of a toothpick for a distance of one-eighth of an inch back from the tip when dipped into the dry powder. Dissolve this amount in 1 teaspoonful of grain alcohol; then stir the alcoholic solution into 1 quart of water. To make a solution containing approximately 500 p.p.m., use a third of a teaspoonful of the substance for each quart of water. To prepare a dust of 1,000 p.p.m. use two-thirds of a teaspoonful of the substance for each 1,000 grams (approximately 35 ounces) of talc, soybean flour, or powdered charcoal.

TABLE 1.-*Coniferous Trees and Shrubs*

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Abies concolor	WHITE FIR	Jan.	IBc – water	80	24	9	17*	0*	Diluted Hormodin A. (57)
Do.	do.	Mar.	IAc – water	100	24	–	68	19	
								0	IAc followed by treatment with 2 percent sucrose for 48 hours. (79)
A. koreana	KOREAN FIR	Mar.	do.	100	–	–	16	0	(79)
Do.	do.	Jan.	do.	200	24	–	70	25	(79)
A. pectinata (A. alba)	SILVER FIR	Jan.	do.	200	24	52	80	4	2-year-old wood. (79)
Do.	do.	Jan.	do.	200	24	52	45	6	Cuttings from an old tree. (79)
A. pinsapo	SPANISH FIR	–	IBc – water	40; 80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
A. veitchi	VEITCH FIR	–	IBc – water	40; 80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Araucaria brasiliana (A. angustifolia)	PARANA ARAUCARIA	–	IAc – water	100	22	–	–	–	Not advantageous. (43)
Chamaecyparis lawsoniana (Cupressus lawsoniana)	LAWSON FALSECYPRESS	Jan.	do.	50	8	4	75	75	Do.
fletcheri	Fletcher	–	IBc – water	40; 80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.

+ Symbols: IAc – indoleacetic acid; IBc – indolebutyric acid; IPc – indolepropionic acid; NAc – naphthaleneacetic acid; NAd – naphthalene acetamide; NBc – naphthalenebutyric acid

TABLE 1.-*Coniferous Trees and Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
C. obtusa	HINOKI FALSECYPRESS	Feb.	IBc – water	20–100	–	–	–	–	Not advantageous. (8)
aurea crippsi	–	–	do.	40;80	24	–	–	–	Advantageous. (49)
Do.	–	–	IBc – talc	12,000	–	–	–	–	Do.
compacta	Compact	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
erecta	Column	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
filicoides	Fernspray	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
filiformis	–	–	IBc – water	40;80	24	–	–	–	Do.
Do.	–	–	IBc – talc	12,000	–	–	–	–	Do.
gracilis	Slender	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
C. pisifera aurea	SAWARA FALSECYPRESS Golden	July	IBc – water	10–80	12	–	–	–	Not advantageous. (8)
filifera	Thread	–	do.	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
filifera aurea	Yellowthread	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
plumosa	Plume	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	Apr.	do.	40	24	12	60*	43*	Diluted Hormodin A; Nov. and Jan. results nearly as good; Oct. results poor. (57)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Advantageous. (49)
Do.	do.	Oct.	IBc – water	30–80	20	10	65	15	(88)
plumosa area	Silvertip	–	do.	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
plumosa nana	Dwarfplume	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Cryptomeria japonica	CRYPTOMERIA	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Cupressus lawsoniana	–	–	–	–	–	–	–	–	(See *Chamaecyparis lawsoniana.*)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65 68.

TABLE 1.-*Coniferous Trees and Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Cupressus macrocarpa	MONTEREY CYPRESS	–	IBc – water	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Juniperus chinensis	PYRAMID CHINESE JUNIPER	Oct.	IBc – water	80	24	20	35*	0*	Diluted Hormodin A. (57)
japonica	JAPANESE JUNIPER	–	do.	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
pfitzeriana	PYRAMID CHINESE JUNIPER Pfitzer	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Do.	do.	Apr.	IBc – water	80	24	21	55*	8*	Diluted Hormodin A; Nov., Jan. and Feb. cuttings responded almost as well. (57)
Do.	do.	Apr.	do.	80	24	21	70*	33*	Diluted Hormodin A. (57)
Do.	do.	Feb.	do.	20–100	18	–	–	–	Treatment not advantageous. (8)
Do.	do.	Oct.	do.	50–80	20	13	40	0	Similar results from earlier cuttings. (88)
pyramidalis	–	–	do.	40;80	24	–	–	–	Advantageous. (49)
Do.	–	–	IBc – talc	12,000	–	–	–	–	Do.
Do.	–	Oct.	IBc – water	20	24	26	30*	15*	Diluted Hormodin A. (57)
Do.	–	Oct.	do.	40	24	26	33*	18*	Do.
J. communis depressa	OLDFIELD COMMON JUNIPER	Feb.	do.	40	24	26	75*	30*	Diluted Hormodin A; April and Oct. results fair. (57)
depressa plumosa	do.	Apr.	do.	20	24	21	35*	8*	Diluted Hormodin A; Jan. cuttings responded poorly. (57)
Do.	do.	Oct.	do.	40	24	13	35*	0*	Do.
Do.	do.	Oct.	do.	40	24	21	45*	13*	Do.
hilli	Dwarf	–	IBc – talc	12,000	–	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – water	40;80	24	–	–	–	Do.
montana	–	–	do.	40;80	24	–	–	–	Do.
Do.	–	–	IBc – talc	12,000	–	–	–	–	Do.
J. conferta	SHORE JUNIPER	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.

+ Symbols: IAc – indoleacetic acid
IBc – indolebutyric acid
IPc – indolepropionic acid
NAc – naphthaleneacetic acid
NAd – naphthalene acetamide
NBc – naphthalenebutyric acid

TABLE 1.-*Coniferous Trees and Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
J. excelsa	GREEK JUNIPER	–	IBc – water	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
stricta	Spiny	July	IBc – water	10–80	12	–	–	–	Not advantageous. (8)
J. horizontalis (J. sabina var. *horizontalis)*	CREEPING JUNIPER	–	do.	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Do.	"Gray Form"	Oct.	IBc – water	20–80	24	20	0*	8*	Diluted Hormodin A. (57)
Do.	"Green Form"	Nov.	do.	40	24	17	60*	8*	Do.
plumosa	ANDORA CREEPING JUNIPER	Oct.	IBc – water	50	20	7	60	60	Aug. and Sept. cuttings gave similar results. (88)
Do.	do.	Feb.	do.	20	18	3	72	64	(7)
J. procumbens	JAPGARDEN JUNIPER	Apr.	do.	80	24	22	18*	0*	Diluted Hormodin A. (57)
J. rigida	NEEDLE JUNIPER	–	do.	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
J. sabina	SAVIN JUNIPER	July	IBc – water	100	24	7	60	0	(61)
Do.	do.	Jan.	do.	40	24	8	10*	0*	Diluted Hormodin A. (57)
tamariscifolia	Tamarix	–	do.	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
J. sabina	SAVIN JUNIPER Vonehron	June	IBc – water	10–100	12	–	–	–	Not advantageous. (8)
J. squamata wilsoni	WILSON SINGLESEED JUNIPER	Jan.	do.	40	24	12	20*	0*	Diluted Hormodin A. (57)
J. virginiana	EASTERN REDCEDAR	July	do.	10–100	24	–	–	–	Not advantageous. (8)
globosa	Globe	Jan.	do.	20–100	18	–	–	–	Do.
keteleeri	Keteleer	Feb.	do.	20–100	18	18	–	–	Do.
Do.	do.	–	do.	40;80	24	–	–	–	Advantageous (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
tripartita	Fountain	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Libocedrus decurrens	CALIFORNIA INCENSE-CEDAR	Nov.	IBc – water	150	24	9	100	50	All cuttings had "remained alive but unrooted in sand-peat for 15 months" before treatments were made. (21)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65–68.

TABLE 1.-*Coniferous Trees and Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Picea abies (P. excelsa)	NORWAY SPRUCE	Nov.	IBc – water	20	24	16	37*	18*	Diluted Hormodin A. (57)
Do.	do.	Nov.	IAc – talc	1,000	–	12	43	33	(29)
Do.	do.	Nov.	do.	1,000	–	42	75	50	Greater survival. (36)
Do.	do.	Jan.–Apr.	IBc	–	–	15	–	–	Treated cuttings were injured. Used water solutions and talc. (34)
Do.	do.	Jan.–Apr.	IAc – talc	–	–	15	–	–	Do.
barryi	Barry	–	IBc – water	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
compacta asselyn	Globe	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
cupressina	Cypress	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
echinaeformis	Hedgehog	–	IBc – water	40;80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Picea glauca (P. canadensis)	WHITE SPRUCE	Mar.	IAc – talc with organic mercury	–	–	15	–	–	Injurious. (34)
conica	Dwarf	–	IBc – water	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
P. mariana	BLACK SPRUCE	Mar.	IAc – talc with organic mercury	–	–	15	–	–	Injurious. (34)
P. omorika	SERBIAN SPRUCE	–	IBc – water	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Do.	do.	–	IAc – water	200	24	–	36	4	(79)
Do.	do.	–	do.	200	24	–	66	17	Followed with vitamin B_1, 0.5 p.p.m., 24 hours. (79)
P. pungens	COLORADO SPRUCE	Jan.	IBc – water	40	24	12	5*	8*	Diluted Hormodin A. (57)
Do.	do.	–	do.	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
kosteriana	Koster	July–Aug.	IAc – water	100	24	–	–	–	All cuttings died. (16)
P. sitchensis	SITKA SPRUCE	Dec.–Mar.	IBc – water	25	24	7	100	5	Percentages determined after 23 weeks; IAc gave similar results. (38)

+ Symbols: IAc – indoleacetic acid
IBc – indolebutyric acid
IPc – indolepropionic acid
NAc – naphthaleneacetic acid
NAd – naphthalene acetamide
NBc – naphthalenebutyric acid

TABLE 1.-*Coniferous Trees and Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Pinus bungeana	LACEBARK PINE	–	IBc – water	40; 80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
P. densiflora var. *umbraculifera*	JAPANESE RED PINE Umbrella	July	IBc – water	10–80	15	–	–	–	Not advantageous. (8)
P. mugo mughus	MUGHO SWISS MOUNTAIN PINE	Jan.	do.	80	24	6	30*	0*	Diluted Hormodin A; poor results with Nov. and Apr. cuttings. (57)
P. mugo slavini	SWISS MOUNTAIN PINE Slavin	–	do.	40; 80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Pinus strobus	EASTERN WHITE PINE	Aug.	IBc – water with or without IAc or IBc talc	25	6	50	48	35	Cuttings from 10-year-old trees, kept outside in sand-peat-manure-mulch bed. (70)
Do.	do.	Mar.	IBc – water	200	5	12	70	–	Cuttings from lower part of a 30-year-old tree; sand-peat. (22)
Do.	do.	July	IBc – water	10–80	24	–	–	–	Not advantageons. (8)
Podocarpus neriifolia	OLEANDER PODOCARPUS	Mar.	IAc – water	100; 200	24	9–14	100	25	Cuttings from 36-year-old tree. (79)
P. parlatorei	PODOCARPUS	–	do.	–	12–24	–	–	–	Advantageous; IAc alone better than 3 commercial preparations tried. (15)
Pseudotsuga taxifolia	COMMON DOUGLASFIR	Dec.–Mar.	IBc – water.	50	24	8–17	80	0	Percentages determined after 23 weeks; IAc also gave good results. (38)
Sciadopitys verticillata	UMBRELLAPINE	Jan.	do.	20	20	–	70	–	(19)
Sequoia gigantea	GIANT SEQUOIA	–	do.	40; 80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
S. sempervirens	REDWOOD	Mar.	IAc – water	100	24	11	34	0	Cuttings from 10-year-old tree. (79)
Taxus baccata	ENGLISH YEW								
fastigiata	Irish	–	IBc – water	40; 80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
glauca	–	–	IBc – water	40; 80	24	–	–	–	Do.
Do.	–	–	IBc – talc	12,000	–	–	–	–	Do.
imperialis	–	–	IBc – water	40; 80	24	–	–	–	Do.
Do.	–	–	IBc – talc	12,000	–	–	–	–	Do.
repandens	Spreading	–	IBc – water	40; 80	24	–	–	–	Do.

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.

§ Numbers in parentheses refer to literature citations, pp. 65–68.

TABLE I.-*Coniferous Trees and Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
Taxus baccata	ENGLISH YEW			*p.p.m.*	*Hours*	*Weeks*			
repandens	Spreading	–	IBc – talc	12,000	–	–	–	–	Advantageous. (49)
Do.	do.	Jan.	IAc – water	5–100	12	–	–	–	Not advantageons. (8)
washingtoni	Washington	Jan.	do.	50	12	13	80	70	(7)
T. cuspidata	JAPANESE YEW	Jan.	do.	50	12	13	100	85	(7)
Do.	do.	June	IBc – water	30	6	14	90	77	(7)
Do.	do.	July	do.	80	24	8	60	0	(61)
Do.	do.	Dec.	do.	40–80	22	8	95	30	Short laterals; winter cuttings rooted more quickly than those of July, Aug., Oct. and Nov. (88)
Do.	do.	–	NAc – water	40	24	9	80	0	(41)
Do.	do.	–	NBc – talc	500–2,000	–	11	20–43	65	Treated cuttings had more and longer roots. (35)
brevifolia [?]	–	Nov.	IBc – water	40	24	17	65*	0*	Diluted Hormodin A. (57)
Do.	–	Apr.	do.	20	24	12	48*	45*	Do.
capitata	JAPANESE YEW	July	do.	10–80	12	–	–	–	Not advantageous. (8)
compacta	–	–	do.	40; 80	24	–	–	–	Treatment advantageous. (49)
Do.	–	–	IBc – talc	12,000	–	–	–	–	Do.
nana	Dwarf	–	IBc – water	40; 80	24	–	–	–	Do.
Do.	do.	Jan.	IAc – water	50	12	13	50	30	(7)
T. media	ANGLOJAP YEW								
hatfieldi	Hatfield	–	IBc – water	40; 80	24	–	–	–	Treatment advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
hicksi	Hicks	–	IBc – water	40; 80	24	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Do.	do.	Jan.	IAc – water	50	12	13	80	30	(7)
Do.	do.	Apr.	IBc – water	80	24	16	83*	20*	Diluted Hormodin A. (57)
Do.	do.	Mar.	do.	20	24	11	83*	48*	Do.
Do.	do.	Mar.	do.	80	24	11	83*	3*	Do.
Do.	do.	June	do.	50	6	14	40	43	(7)
Thuja occidentalis	EASTERN ARBORVITAE; NORTHERN WHITE-CEDAR	Jan.	do.	20	24	–	10*	–	Diluted Hormodin A. (57)
Do.	do.	Jan.	do.	40	24	6–26	26–80*	1–18*	Diluted Hormodin A. longer rooting times gave best results. (57)

+ Symbols: IAc – indoleacetic acid; IBc – indolebutyric acid; IPc – indolepropionic acid; NAc – naphthaleneacetic acid; NAd – naphthalene acetamide; NBc – naphthalenebutyric acid

TABLE 1.-*Coniferous Trees and Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Thuja occidentalis	EASTERN ARBORVITAE; NORTHERN WHITE-CEDAR	July	IBc - water	40	24	6	40	0	(61)
Do.	do.	Oct.	do.	40	24	18	35*	5*	Diluted Hormodin A. (57)
Do.	do.	Oct.	do.	40	24	5	68*	25*	Do.
Do.	do.	Oct.	do.	40	24	13	18*	28*	Do.
filiformis	Douglas	-	do.	40;80	24	-	-	-	Advantageous. (49)
Do.	do.	-	IBc - talc	12,000	-	-	-	-	Do.
globosa	Globe; Tom Thumb	-	IBc - water	40;80	24	-	-	-	Do.
Do.	do.	-	IBc - talc	12,000	-	-	-	-	Do.
Do.	do.	Oct.	IBc - water	60-80	20	10	85	25	(88)
globosa nana	do.	-	do.	40;80	24	-	-	-	Advantageous. (49)
Do.	do.	-	IBc - talc	12,000	-	-	-	-	Do.
hoopesi	-	-	IBc - water	40;80	24	-	-	-	Do.
Do.	-	-	IBc - talc	12,000	-	-	-	-	Do.
hoveyi	Hovey	-	IBc - water	40;80	24	-	-	-	Do.
Do.	do.	-	IBc - talc	12,000	-	-	-	-	Do.
hudsonica	-	-	IBc - water	40;80	24	-	-	-	Do.
Do.	-	-	IBc - talc	12,000	-	-	-	-	Do.
pyramidalis	Pyramidal Eastern	June	IBc - water	100	24	8	80	0	(61)
spiralis	-	-	do	40;80	24	-	-	-	Advantageous. (49)
Do.	-	-	IBc - talc	12,000	-	-	-	-	Do.
wareana	Ware	Oct.	IBc - water	40	24	18	58*	18*	Diluted Hormodin A. (57)
Do.	do.	Dec.	do.	40	24	17	53*	8*	Do.
Do.	do.	Mar.	do.	20	24	19	20*	0*	Do.
Do.	do.	June	do.	100	24	7	80	0	(61)
T. orientalis aurea nana	ORIENTAL ARBORVITAE Berckmanns	July	do.	10-80	12	-	-	-	Not advantageous. (8)
T. plicata	GIANT ARBORVITAE	Jan.	do.	80-100	22	9	79	0	(88)
Thujopsis dolabrata	HIBA FALSE-ARBORVITAE	Summer	IAc - water	50	24	12	-	-	45 percent more rooted. (81)
Tsuga canadensis	CANADA HEMLOCK; EASTERN HEMLOCK	Jan.	IBc - water	50-100	22	9	79	0	(88)
dawsoniana	Dawson	-	do.	40;80	24	-	-	-	Advantageous. (49)
Do.	do.	-	IBc - talc	12,000	-	-	-	-	Do.

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65-68.

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TABLE 1.-*Coniferous Trees and Shrubs*-Concluded

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
Tsuga canadensis				*p.p.m.*	*Hours*	*Weeks*			
minima	-	-	IBc - water	40;80	24	-	-	-	Advantageous. (49)
Do.	-	-	IBc - talc	12,000	-	-	-	-	Do.
pendula	Sargent Weeping	-	IBc - water	40;80	24	-	-	-	Do.
Do.	do.	-	IBc - talc	12,000	-	-	-	-	Do.
T. heterophylla	PACIFIC OR WESTERN HEMLOCK	Jan.	IAc - water	-	-	-	-	-	Advantageous. (54)
T. sieboldi	SIEBOLD HEMLOCK	-	IBc - water	40;80	24	-	-	-	Advantageous. (49)
Do.	do.	-	IBc - talc	12,000	-	-	-	-	Do.

TABLE 2.-*Broadleaf Trees*

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Acacia alata	WINGED ACACIA	July	IAc or NAc - water	100	24	-	-	-	Not advantageous. (81)
A. decurrens									
dealbata	SILVERGREEN WATTLE ACACIA	July	do.	100	24	-	-	-	Do.
A. longifolia									
mucronata	NARROW SYDNEY ACACIA	June	NAc - water	33.3	24	-	-	-	Do.
Acer campestre	HEDGE MAPLE	June	IBc - water	10-80	12	-	-	-	Not advantageous. (8)
A. palmatum	JAPANESE MAPLE	Spring, Summer	IAc or IPc - lanolin	30,000-100,000	-	1-3	46	5	More roots per cutting, earlier rooting. (41)
Do.	do.	June	IBc - water	50	20	6	20	0	(7)
A. platanoides	NORWAY MAPLE	June	IAc - water	100	24	-	-	-	Slightly advantageous. (78)
A. rubrum	RED MAPLE	June	IBc - water	200	6	8	63	0	Softwood; clonal variation in response. (71)
Do.	do.	July	do.	10	6	11	50	0	(1)
A. rufinerve	REDVEIN MAPLE								
albo-limbatum	Whitedot	Oct.	NAc - water	50	24	-	12	0	(81)

+ Symbols: IAc - indoleacetic acid; IBc - indolebutyric acid; IPc - indolepropionic acid; NAc - naphthaleneacetic acid; NAd - naphthalene acetamide; NBc - naphthalenebutyric acid

TABLE 2.-*Broadleaf Trees*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
A. saccharinum	SILVER MAPLE	June	IBc – water	50	32	–	85	0	(50)
A. saccharum	SUGAR MAPLE	June	do.	50	3	8	66	35	Softwood. (71)
Annona cherimola	CHERIMOYA	–	IAc – water	100	22	–	–	–	Not advantageous. (43)
Betula pendula	EUROPEAN WHITE BIRCH								
fastigiata Hort.	–	July	do.	100	24	5	21	0	(1)
youngi	Youngs	July	do.	100	24	4	10	0	(66)
B. [*populifolia ?*]	GRAY BIRCH	July	IBc – water	7.5–10	6	10	30	10	Softwood; Aug. cuttings did not respond. (66)
Betula sp.	WHITE BIRCH	July	IBc – water	20	24	–	50	0	2-year-old wood. (1)
Cananga odorata	ILANGILANG; YLANGYLANG	–	IAc – water	100	22	–	–	–	Not advantageous. (43)
Carica papaya	PAPAYA	–	IBc – water	100	42	–	50	28	Bottom heat also effective. (82)
Do.	do.	–	IAc – water	200	–	–	–	–	Re-treating after callus formation caused rooting. (14)
Carpinus betulus	EUROPEAN HORNBEAM	Nov.	IBc or IAc – water	50–100	40	–	–	–	Not advantageous. (8)
Carya pecan	PECAN	Apr.	IBc – talc	2,000–12,000	–	–	–	–	Advantageous. (42)
Do.	do.	Apr.	IBc – water	40	24	–	–	–	Do.
Do.	do.	–	IBc – alcohol	–	–	–	–	–	Soak toothpicks 24 hours in solution (1 gm – 21 cc.) insert into lateral roots at transplanting. (68)
Do.	do.	–	IBc –	–	–	–	–	–	Toothpick carrying 1 mg. inserted into hole in each cutting of 1 inch diameter. (27)
Do.	Posey	Apr.	IBc – water	100	24	–	63	0	Wood 2–4 years old, callused 3 weeks before treating. (72)
Cinnamomum camphora	CAMPHORTREE	–	IAc – water	100	22	–	–	–	Slight effect. (43)
Citrus aurantifolia	LIME								
	Bearss	June	do.	100–900	24	–	95	70	More roots per cutting. (5)
Do.	Rangpur	Feb., Mar.*	do.	200	24	3	100	100	More roots per cutting. (13)
Do.	Woglum	Feb., Mar.	do.	200	24	3	100	100	Do.
C. aurantium	SOUR ORANGE	June	do.	100	24	–	90	60	More roots per cutting. (5)
C. limonia	LEMON	–	do.	100–250	48–60	–	–	–	Hastened rooting; more roots and stronger root systems. (84)
Do.	do.	–	do.	100–250	48–60	–	–	–	Leaves; hastened rooting. (84)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65–68.

TABLE 2.-*Broadleaf Trees*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Citrus limonia	LEMON	-	IAc - water	500	20	6	-	-	Treated cuttings averaged 33.3 roots, controls 4.3. (12)
Do.	Eureka	June	do.	100-900	24	-	98	90	More roots per cutting. (5)
Do.	do.	Apr.	IAc - lanolin	500	-	4	-	-	10 mg. per treatment; rooting increased and hastened. (11)
Citrus nobilis unshiu	SATSUMA ORANGE	June	IAc - water	200	24	-	70	30	Few more roots per cutting. (5)
C. paradisi	MARSH GRAPEFRUIT	June	do.	500	24	-	80	10	Fewer roots per cutting, but longer. (5)
C. sinensis	COMMON OR SWEET ORANGE	Jan.	do.	100	8	3	100	60	(43)
Do.	Hamlin	-	do.	200	-	6	-	0	Treated cuttings had 1-2 roots; re-treatment after 3 weeks increased number of roots. (14)
Do.	Navel	June	do.	200	24	-	40	30	More roots per cutting. (5)
Do.	Valencia	June	do.	500-700	24	-	50	30	Do.
C. sinensis x *Poncirus trifoliata*	MORTON CITRANGE	Feb., Mar.	do.	200	24	6	80	0	(13)
C. unshiu [*C. nobilis* var. *unshiu* ?]	TANGERINE ORANGE	Spring	do.	100-500	24-48	8	50	0	(26)
Do.	do.	Winter	do.	100	36	8	31	0	(26)
Citrus spp.	-	-	-	-	-	-	-	-	See also *Fortunella*, table 3, and *Poncirus*, table 2.
Cladrastis lutea	AMERICAN YELLOWWOOD	July	IAc - water	200	24	6	100	100	(66)
Coffea arabica	-	-	-	-	-	-	-	-	See table 3.
Cornus florida	FLOWERING DOGWOOD	July	IAc - water	200	24	5	25	0	(66)
rubra	Redflowering	July	IBc - water	50	4	4	60	0	Results best if wood taken just before terminal buds had formed. (88)
Do.	do.	July	do.	5-80	10-18	-	-	-	Not advantageous. (8)
Cornus spp.	-	-	-	-	-	-	-	-	See also table 3.
Crataegus phaenopyrum (*C. cordata*)	WASHINGTON HAWTHORN	July	IBc - water	10-80	24	-	-	-	Not advantageous. (8)
Crataegus sp.	-	-	-	-	-	-	-	-	See also *Pyracantha coccinea*, table 3.
Davidia involucrata	DOVETREE	July	IAc - water	100	24	6	33	0	(66)
Erythrina corralodendrum	COMMON CORALBEAN	May	do.	200	24	3	100	0	(85)

+ Symbols: IAc - indoleacetic acid; IBc - indolebutyric acid; IPc - indolepropionic acid; NAc - naphthaleneacetic acid; NAd - naphthalene acetamide; NBc - naphthalenebutyric acid

TABLE 2.-*Broadleaf Trees*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Eucalyptus globulus	TASMANIAN BLUE EUCALYPTUS; TASMANIAN BLUEGUM.	–	IAc – water	100	22	–	–	–	Not advantageous. (43)
Eucommia ulmoides	EUCOMMIA	July	do.	100	24	–	–	–	Not advantageous. (81)
Euphoria litchi	EUPHORIA	–	do.	100	22	–	–	–	Not advantageous. (43)
Fagus sylvatica	EUROPEAN BEECH	Summer	do.	200	24	5	50	0	Softwood cuttings taken when the last 1 or 2 leaves on twig were developing. (66)
pendula	Weeping	July	do.	200	24	5	50	0	(66)
Ficus australis	-	–	–	–	–	–	–	–	See *F. rubiginosa*.
F. carica	COMMON FIG	Feb.	IAc – lanolin	–	–	4	100	50	Leafless cuttings; application above basal cut. (24)
Do.	do.	Feb.	do.	500	–	3	–	–	10 mg. per treatment; treated cuttings averaged 11 roots, controls 6.1. (11)
Do.	Calimyrna	Mar.	IAc – water	200	24	5	100	80	(85)
F. cyatistipula Warb.	–	Dec.	do.	100	22	4	80	90	More roots on treated cuttings. (43)
F. porteana Regel	–	–	do.	100	22	–	–	–	Slight effect. (43)
F. retusa (F. nitida)	INDIALAUREL FIG	Dec.	do.	100	24	2	90	0	(43)
F. rubiginosa (F. australis)	RUSTY FIG	Jan.	do.	100	8	3	40	13	(43)
Ginkgo biloba	MAIDENHAIR TREE	July	IBc – water	50	20	5	90	80	Cuttings taken after terminals had formed. (88)
Grevillea juniperina sulphurea	YELLOW JUNIPER GREVILLEA	Oct.	IAc – water	20	24	–	–	–	10 percent more cuttings rooted. (81)
Griselina littoralis	KUPUKATREE	May	do.	50	48	–	–	–	Slightly advantageous. (81)
Halesia carolina (H. tetraptera)	CAROLINA SILVERBELL	July	IBc – water	25	20	6	80	40	(20)
Do.	do.	July	do.	10–80	10	–	–	–	Not advantageous. (8)
Do.	do.	July	IAc – water	100	48	6	70	0	(66)
H. monticola	MOUNTAIN SILVERBELL	July	IBc – water	25	20	6	80	40	(20)
Hamamelis virginiana	COMMON WITCH-HAZEL	July	IAc – water	200	24	5	33	0	(66)
Hevea brasiliensis	PARA RUBBERTREE	–	NAc – water	–	–	–	–	–	Marked stimulation. (4)
Hymenaea courbaril	COURBARIL	–	IAc – water	100	22	–	–	–	Not advantageous. (43)
Ilex aquifolium	ENGLISH HOLLY	Jan.	IAc – water	100	8	5	75	0	(43)
Do.	do.	–	IBc – water	40–80	24	–	–	–	Advantageous. (49)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65–68.

TABLE 2.-*Broadleaf Trees*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Ilex aquifolium	ENGLISH HOLLY	–	IBc – talc	12,000	–	–	–	–	Advantageous. (49)
I. opaca	AMERICAN HOLLY	–	IBc – water	40–80	24	–	–	–	Advantageous any time of year except early summer. (49
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Do.	do.	Dec.	IAc – water	200	6	5	100	0	Some controls rooted later. (41)
Do.	do.	Oct.	IBc – water	100	18	3	96	0	Wood nearly mature. (88)
Do.	do.	June	do.	30	24	6	53	0	(7)
Ilex spp.	–	–	–	–	–	–	–	–	See also table 3.
Larix decidua	EUROPEAN LARCH	July	IBc – water	10–80	10	–	–	–	Not advantageous. (8)
Laurus camphora	–	–	–	–	–	–	–	–	See *Cinnamomum camphora.*
L. nobilis	TRUE BAY; GRECIAN LAUREL.	–	IAc – water	100	22	–	–	–	Slight effect. (43)
Liriodendron tulipifera	TULIPTREE; YELLOW POPLAR	July	do.	200	24	6	33	0	(66)
Macadamia ternifolia	QUEENSLANDNUT MACADAMIA	-	do.	100	22	–	–	–	Not advantageous. (43)
Maclura pomifera (M. aurantiaca)	OSAGEORANGE	July	do.	100	24	6	100	60	(66)
Magnolia denudata	YULAN MAGNOLIA	July	do.	200	24	6	80	0	(66)
M. kobus	KOBUS MAGNOLIA	Aug.	IBc or NAc – water	5–20	24	–	–	–	Not advantageous. (8)
borealis	do.	June	IBc – water	80–100	22	3	58	0	Actively growing wheu cuttings takeu. (88)
M. parviflora (M. sieboldi)	OYAMA MAGNOLIA	July	IAc – water	100	24	6	100	50	(66)
M. sinensis	CHINESE MAGNOLIA	July, Aug.	do.	100	30	4	–	–	Not advantageous. (16)
Do.	do.	May.	do.	200	24	3	100	0	(85)
Magnolia spp.	–	–	–	–	–	–	–	–	See also table 3.
Malus spp.	–	–	–	–	–	–	–	–	See *Pyrus.*
Mangifera indica	COMMON MANGO	–	IAc – lanolin	10,000	–	6	–	0	Only treated cuttings rooted. (39)
Do.	do.	–	do.	30,000	–	–	–	0	Advantageous; paste applied to young attached twigs from which cuttings were taken 24 hours later. (40)
Morus alba	WHITE MULBERRY	July	IAc – water	100	22	4	76	47	Softwood cuttings. (85)
Do.	do.	July	do.	100; 200	22	4	0	0	Hardwood cuttings. (85)

+ Symbols: IAc – indoleacetic acid; IBc – iudolebutyric acid; IPc – iudolepropionic acid; NAc – naphthaleneacetic acid; NAd – uaphthalene acetamide; NBc – naphthaleuebutyric acid

TABLE 2.-*Broadleaf Trees*- Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED+	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Morus alba	WHITE MULBERRY	Jan.	IAc - water	100	8	2	100	66	Basal cuttings better; buds inhibited by treatment. (43)
M. nigra	BLACK MULBERRY	Jan.	do.	100	8	3	62	12	(43)
Myrica californica	PACIFIC WAXMYRTLE	June	do.	200	20	5	100	12	Softwood cuttings. (85)
Do.	do.	June	do.	100	20	5	25	11	Hardwood cuttings. (85)
Myrica spp.	-	-	-	-	-	-	-	-	See also table 3.
Olea europaea	COMMON OLIVE	Feb.	IAc - lanolin	-	-	4	0	-	Paste applied on cut surface; also crystals put under bark. (24)
Olea sp.	OLIVE	-	IAc - water	100-250	48-60	-	-	-	1-year-old cuttings; treatment induced only calluses. (84)
Oxydendrum arboreum	SOURWOOD	July	IBc - water	90	8	8	80	0	(67)
Parrotia persica	PERSIAN PARROTIA	July	IAc - water	100	24	5	100	50	(66)
Poncirus trifoliata	TRIFOLIATE ORANGE	Dec.	do.	200	24	4	100	-	Few controls rooted in 3-4 months. (26)
Do.	do.	Dec.	NAc - water	100	17	9	60	0	IBc unsuccessful. (21)
P. trifoliata x *Citrus sinensis*	-	-	-	-	-	-	-	-	See *C. sinensis* x *P. trifoliata.*
Populus alba x *P. nivea*	WHITE POPLAR	-	IBc - water	10-20	-	-	50	0	From root suckers. (1)
P. alba	do								
bolleana	Bolleana	-	IAc - lanolin	5,000	-	24	42	19	(52)
pyramidalis	-	Aug.	IAc - water	100	24	3	56	20	(52)
P. grandidentata	BIGTOOTH ASPEN	Mar.	IBc - water	10	27	8	67	5	From dormant wood. (69)
P. tremuloides	QUAKING OR TREMBLING ASPEN; AMERICAN ASPEN	Mar.	do.	10	27	8	67	5	Do.
Populus sp.	ASPEN	Aug.	do.	10-40	48	7	4	0	(1)
Prunus cerasifera	MYROBALAN PLUM								
	Myrobalan A	July	IAc - water	25	24	4	-	-	Increased percentage rooted. (54)
Do.	Myrobalan B	July	do.	25	24	2	-	-	Do.
pissardi	Pissard	July	IBc - water	10-80	18	-	-	-	Not advantageous. (8)
P. padus	EUROPEAN BIRDCHERRY	July	do.	22	20	-	53	33	Diluted Auxilin 3; softwood; leaf-bud cuttings did not respond. (55)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65-68.

TABLE 2.-*Broadleaf Trees*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Prunus subhirtella	HIGAN CHERRY; ROSEBUD CHERRY; JAPANESE FLOWERING CHERRY								
pendula	Weeping	July	IBc - water	10-80	10	-	-	-	Not advantageous. (8)
P. tomentosa	MANCHU CHERRY	July	do.	22	20	-	34	0	Diluted Auxilin 3; leaf-bud cuttings. (55)
Do.	Do.	June	do.	10	6	4	84	4	(7)
Prunus sp.	CHERRY								
	Malling rootstock F 12/1	Aug.	do.	10	24	6	90	0	Rapidly growing shoots less desirable. (62)
Do.	Malling rootstock F 251/1	June	do.	15	24	4	90	50	Do.
Do.	Malling rootstock F 251/2	June	do.	15	24	4	100	90	Do.
Do.	Malling rootstock F 251/3	June	do.	15	24	4	90	40	Do.
Do.	PLUM								
	Rootstock Brompton	July	do.	20	24	7	80	10	Slowly growing shoots. (62)
Do.	Rootstock Myrobalan B	May	do.	20	24	3	100	80	Do.
Do.	Rootstock Pershore	July	do.	20	24	7	30	0	Do.
Do.	Scion Victoria	July	NAc - water	15	24	7	80	0	Do.
Prunus spp.	-	-	-	-	-	-	-	-	See also table 3.
Pterocarya stenoptera	CHINESE WINGNUT	-	IBc - water	20	-	3	90	0	Diluted Hormorin A. (86)
Do.	do.	July	IAc - water	20	24	10	33	0	(66)
Pterostyrax hispidum	FRAGRANT EPAULETTETREE	July	do.	200	24	4	47	9	(66)
Punica granatum	POMEGRANATE								
nana	Dwarf	July, Aug.	IAc - water	100	18	4	-	-	Advantageous; spring cuttings less desirable. (16)
Pyrus (Malus eleyi Hort.)	-	July	IBc - water	50	4	5	70	0	Wood from young trees in active growth. (88)
P. malus (Malus pumila)	APPLE								
	Antonovka	June	IBc - water	10-100	24	-	-	-	All cuttings died. (61)
Do.	Athabasca	June	do.	10-100	24	-	-	-	Do.
Do.	Scion var. Bramley's Seedling	Jnly	do.	15	24	7	50	0	Cuttings from established trees. (62)

+ Symbols: IAc - indoleacetic acid; IBc - indolebutyric acid; IPc - indolepropionic acid; NAc - naphthaleneacetic acid; NAd - naphthalene acetamide; NBc - naphthalenebutyric acid

TABLE 2.-*Broadleaf Trees*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
P. malus (Malus pumila)	APPLE								
Do.	Doucin	Mar.	IAc - lanolin	-	-	1	70	100	1.6 mg. IAc on cut surface. (24)
Do.	Erie	June	IBc - water	10-100	24	-	-	-	All cuttings died. (61)
Do.	Grimes Golden	Nov.	do.	40	24	-	-	-	Advantageous. (42)
Do.	do.	Nov.	do.	400-1,000	dip	-	-	-	Do.
Do.	do.	Nov.	IBc - talc	10,000-25,000	-	-	-	-	Do.
Do.	Hashabi	Feb.	IAc - lanolin	-	-	2	0	0	1.2 mg. IAc applied under bark above cut surface. (24)
Do.	Hibernal	June	IBc - water	10-100	24	-	-	-	All cuttings died. (88)
Do.	Malling Rootstock No. 1	June	do.	20	24	3	100	0	Cuttings from stoolbed shoots. (62)
Do.	Malling Rootstock No. 9	May	NAc - water	5	24	3	30	0	Cuttings from bedded rootstocks. (62)
Do.	Patten Greening	Aug.	IBc - water	10-100	24	-	-	-	No cuttings rooted. (88)
Do.	Rhode Island Greening	Nov.	do.	400-1,000	dip	-	-	-	Advantageous. (42)
Do.	do.	Nov.	do.	40	24	-	-	-	Do.
Do.	do.	Nov.	IBc - talc	10,000-25,000	-	-	-	-	Do.
sylvestris	APPLE	Nov.	IBc - water	20	24	4	30*	0*	Diluted Hormodin A; root sprouts. (57)
P. pulcherrima (Malus floribunda)	FLOWERING CRAB	July	do.	10-100	24	-	-	-	All cuttings died. (88)
arnoldiana	ARNOLD CRAB	June	IBc - water	50	20	-	60	0	(21)
Do.	do.	Aug.	IBc, IAc, or indolepropionate	100	21	-	-	-	Not advantageous. (8)
P. (Malus purpurea)	PURPLE CRAB	June	IBc - water	10-50	12	-	-	-	Do.
Pyrus sp.	PEAR								
	Malling Rootstock B.2	July	do.	20	-	6	90	0	Slowly growing shoots from established trees. (62)
Do.	Malling Rootstock C.2	July	do.	30	24	8	80	0	Do.
Do.	Malling Rootstock C.3	July	do.	40	24	6	60	0	Do.
Do.	Malling Rootstock C.4	July	NAc - water	40	24	8	80	0	Do.

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65-68.

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TABLE 2.-*Broadleaf Trees*-Concluded

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Quercus robur	ENGLISH OAK	July	IAc – water	50	18	–	56	0	From trees 6–8 years old. (50)
Do.	do.	July	do.	200	18	–	34	0	From trees 20 years old. (50)
fastigiata	Pyramidal	June, July	IBc – water	10–80	3;24	–	–	–	Not advantageous. (8)
Q. suber	CORK OAK	–	IAc – water	100	22	–	–	–	Not advantageous. (43)
Quercus sp.	RED OAK	Feb.	do.	400	24	–	82	22	4-year-old trees, wood more than 1 year old; cuttings from mature trees did not respond. (78)
Robinia pseudacacia	BLACK LOCUST	–	NAc – water	100	24	–	75	–	Hardwood; winter and early spring; allowed to callus before treating. (74)
Salix spp.	–	–	–	–	–	–	–	–	See table 3.
Syringa spp.	–	–	–	–	–	–	–	–	See table 3.
Toxylon sp.	–	– –	–	–	–	–	–	–	See *Maclura*.
Ulmus americana	AMERICAN ELM	June	IBc – water	50	24	5	94	23	Percentage for controls determined after 12 weeks. (21)
U. pumila	SIBERIAN ELM	July	do.	5–20	24	–	–	–	Not advantageous. (8)
Do.	do.	–	do.	80	24	4	60	0	Diluted Hormodin A. (86)
[*Ulmus* sp. ?]	EVERGREEN ELM	June	IAc – water	200	24	3	100	0	(85)
Zelkova serrata	JAPANESE ZELKOVA	July	do.	200	24	4	91	0	(66)

+ Symbols: IAc – indoleacetic acid; IBc – indolebutyric acid; IPc – indolepropionic acid; NAc – naphthaleneacetic acid; NAd – naphthalene acetamide; NBc – naphthalenebutyric acid

TABLE 3.-*Broadleaf Shrubs*

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Abelia grandiflora	GLOSSY ABELIA	July	IBc – water	5–20	24	–	–	–	Not advantageous. (8)
Do.	do.	July	do.	50	21	5	93	33	Growing wood best; rooting hastened. (87)
rosea alba	do.	–	do.	10	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
Acacia spp.	–	–	–	–	–	–	–	–	See table 2.
Acalypha hispida	RED-HOT CAT-TAIL; CHENILE COPPERLEAF	Apr.	IBc – water	10	24	3	42*	7*	Diluted Hormodin A. (57)
wilkesiana marginata	do.	Apr.	do.	10	24	3	95*	47*	Do.
Acalypha sp.	COPPERLEAF	Mar.	IAc – lanolin	500	–	1	–	–	10 mg. per treatment; treated cuttings averaged 57.5 roots, controls 9.3. (11)
Acanthopanax sieboldianus (A. pentaphyllus)	ACANTHOPANAX	Aug.	IBc – water	100	20	8	80	50	(7)
Acer spp.	–	–	–	–	–	–	–	–	See table 2.
Amorpha sp.	FALSE INDIGO	Apr.	IAc – water	200	24	5	8	0	Hardwood cuttings. (85)
Do.	do.	Apr.	do.	200	24	5	87	50	Softwood cuttings. (85)
Andromeda japonica	–	–	–	–	–	–	–	–	See *Pieris japonica*.
Arbutus unedo	STRAWBERRY MADRONE	–	IAc – water	100	22	–	–	–	Not advantageous. (43)
Do.	New Scarlet	Feb., Apr.	do.	100	24	11	–	–	Treated cuttings rooted, controls died. (16)
Arctostaphylos manzanita	COMMON MANZANITA	Dec.	Hortomone A	–	–	26	–	–	Chemical injected on toothpicks effective. (58)
A. uva-ursi	–	–	–	–	–	–	–	–	See table 5.
Aronia arbutifolia	RED CHOKEBERRY	July	IBc – water	10–80	10	–	–	–	Not advantageous. (8)
Aucuba japonica	JAPANESE AUCUBA	Jan.	IAc – water	50	8	7	90	50	(43)
Azalea spp.	–	–	–	–	–	–	–	–	See *Rhododendron*.
Benzoin aestivale	COMMON SPICEBUSH; WILD ALLSPICE	July	IBc – water	5–40	24	24	–	–	Not advantageous. (8)
Berberis thunbergi	JAPANESE BARBERRY	Oct.	do.	20	24	4	27*	0*	Diluted Hormodin A; hardwood cuttings. (57)
Do.	do.	Oct.	do.	10	24	3	30*	5*	Do.
atropurpurea	REDLEAF JAPANESE BARBERRY	Aug.	Indolepropionate – water	100	24	6	45	0	(8)
pluriflora erecta	JAPANESE BARBERRY	July	IBc – water	10	6	7	47	32	(8)
Buddleia alternifolia	FOUNTAIN BUTTERFLYBUSH	July	IAc – lanolin	1,000	–	–	–	–	Hastened rooting. (81)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
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TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Buddleia alternifolia	FOUNTAIN BUTTERFLYBUSH	July	NAc - lanolin	10,000	-	-	-	-	Hastened rooting. (81)
B. asiatica	ASIAN BUTTERFLYBUSH	Mar.	IBc - water	5	24	3	73*	36*	Diluted Hormodin A. (57)
Do.	do.	May.	do.	2.5	24	3	80*	46*	Do.
B. davidi	ORANGEEYE BUTTERFLYBUSH	Oct.	do.	5	24	2	57*	2*	Diluted Hormodin A; hardwood cuttings. (57)
Do.	do.	Oct.	do.	2.5	24	2	60*	15*	Diluted Hormodin A; softwood cuttings. (57)
Buddleia sp.	BUTTERFLYBUSH	-	IAc - water	100	-	2	70	0	(52)
Buxus harlandi	HARLANDS BOX	-	IBc - water	20	24	-	-	-	Advantageous. (49)
B. microphylla									
japonica	JAPANESE LITTLE-LEAF BOX	-	IBc - talc	12,000	-	-	-	-	Do.
Do.	do.	-	IBc - water	20	24	-	-	-	Do.
koreana	KOREAN LITTLE-LEAF BOX	-	do.	20	24	-	-	-	Do.
Do.	do.	-	IBc - talc	12,000	-	-	-	-	Do.
B. quadrangularis	-	-	IAc - water	100	22	-	-	-	Not advantageous. (43)
B. sempervirens	COMMON BOX	Mar.	IBc - water	80	24	9	70*	5*	Diluted Hormodin A; Jan. results similar. (57)
Do.	do.	-	IAc - water	-	12-24	-	-	-	Advantageous; IAc alone better than 3 commercial products tried. (15)
arborescens	Truetree	Oct.	IBc - water	30-50	20	10	70	33	Earlier cuttings also responded. (88)
Do.	do.	-	do.	40	24	-	-	-	Advantageous. (49)
Do.	do.	-	IBc - talc	12,000	-	-	-	-	Do.
handsworthi	Handsworth	-	do.	12,000	-	-	-	-	Do.
Do.	do.	-	IBc - water	40	24	-	-	-	Do.
Do.	do.	Oct.	do.	30	20	10	100	70	(88)
Callicarpa dichotoma (C. purpurea)	PURPLE BEAUTYBERRY	July	IBc - water	30-100	20	2	100	87	Easily rooted at different stages of growth. (88)
C. japonica	JAPANESE BEAUTYBERRY	Oct.	do.	20	24	3	65*	10*	Diluted Hormodin A. (57)
Calluna vulgaris	SCOTCH HEATHER	-	do.	20;40	24	-	-	-	Advantageous. (49)
Do.	do.	-	IBc - talc	12,000	-	-	-	-	Do.
Calycanthus floridus	COMMON SWEETSHRUB	July	IBc - water	5-20	24	-	-	-	Not advantageous. (8)

+ Symbols: IAc - indoleacetic acid; IBc - indolebutyric acid; IPc - indolepropionic acid; NAc - naphthaleneacetic acid; NAd - naphthalene acetamide; NBc - naphthalenebutyric acid

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Calycanthus occidentalis	CALIFORNIA SWEETSHRUB	June	IAc – water	100	20	5	0	0	Hardwood cuttings. (85)
Do.	do.	June	do.	100	20	5	0	0	Softwood cuttings; leaves fell. (85)
Camellia japonica	COMMON CAMELLIA White	Feb.	do.	200	–	3	0	–	Cuttings treated in Feb. were re-treated in Mar.; many rooted 2 weeks after second treatment. (85)
		Mar.	do.	200	–	2	70	–	
alba-plena	Alba Plena	–	IBc – water	40; 80	24	–	–	–	Re-treatment after callus formation effective. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
chandleri elegans	Chandleri Elegans	–	IBc – water	40; 80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
magnoliiflora	Magnoliaflora	July, Aug.	IAc – water	100	18	5	–	–	Advantageous; formation of callus retarded. (16)
C. sasanqua	SASANQUA CAMELLIA	July, Aug.	do.	100	30	4	–	–	Not advantageous. (16)
Caragana arborescens	SIBERIAN PEASHRUB								
pendula	Weeping	July	do.	200	24	6	67	67	(66)
C. frutex	RUSSIAN PEASHRUB	Nov.	IBc – water	20	24	8	62*	45*	Diluted Hormodin A. (57)
C. pygmaea	PYGMY PEASHRUB	July	IAc – water	20	24	5	8	0	(66)
Caryopteris incana	COMMON BLUEBEARD	Apr.	IBc – water	20	24	5	97*	70*	Diluted Hormodin A. (57)
Do.	do.	Oct.	do.	10	24	3	60*	7*	Do.
Cassine maurocenia	–	–	–	–	–	–	–	–	See *Maurocenia capensis*.
Ceanothus cyaneus	SAN DIEGO CEANOTHUS	May	IAc – water	200	24	6	25	–	Hardwood cuttings. (85)
Do.	do.	May	do.	200	24	6	90	0	Softwood cuttings. (85)
C. hybridus (C. delilianus)	DELISLE CEANOTHUS Marie Simon	July	do.	100	24	4	100	60	(66)
C. ovatus	INLAND CEANOTHUS	Oct.	IBc – water	10	24	6	37*	5*	Diluted Hormodin A. (57)
Cephalanthus occidentalis	COMMON BUTTONBUSH	July	IAc – water	20–200	24	4	100	100	(66)
Chaenomeles lagenaria	JAPANESE QUINCE; JAPONICA	July	IBc – water	10–80	12	–	–	–	Not advantageous. (8)
Chorizema varium	BUSH FLAMEPEA	Dec.	IAc – water	100	22	4	100	30	Increased number of roots. (43)
Citrus spp.	–	–	–	–	–	–	–	–	See *Fortunella*; also *Citrus*, table 2.

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
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TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Clerodendron bungei (*C. foetidum*)	ROSE GLORYBOWER	Dec.	IAc – water	200	–	3	50	0	Cuttings not rooted after Dec. treatment were retreated in Jan; all retreated cuttings rooted 2 weeks after second treatment. (85)
		Jan.	do.	200	–	2	100	20	
C. thompsonae	BLEEDINGHEART GLORYBOWER	Feb.	IBc – water	20	24	6	72*	53*	Diluted Hormodin A; Nov. results also good. (57)
Codiaeum variegatum	CROTON; VARIEGATED LEAFCROTON	Feb.	do.	20	26	5	60*	3*	Diluted Hormodin A. (57)
Coffea arabica	COMMON OR ARABIAN COFFEE	–	IAc – water	100	18	9	79	7	Current season's growth. (25)
Coriaria sp.	CORIARIA	July	NAc – talc	1,000	–	3	85	58	(73)
Cornus alba	TATARIAN DOGWOOD	–	IAc – lanolin	5,000	–	36	93	50	(52)
C. ammomum	SILKY DOGWOOD	July	IBc – water	30	20	3	73	53	Cuttings taken when terminal buds were forming. (88)
C. mas	CORNELIANCHERRY DOGWOOD	July, Aug.	do.	5–30	24	–	–	–	Not advantageous. (8)
C. obliqua (*C. purpusi*)	PALE DOGWOOD	–	IAc – lanolin	5,000	–	36	73	27	(52)
C. racemosa (*C. paniculata*)	GRAY DOGWOOD	July	IBc – water	80–100	4	6	66	0	Best results if cuttings taken just before terminal buds had formed. (88)
C. sanguinea	BLOODTWIG DOGWOOD	June	do.	30	12	3	68	44	(7)
Cornus spp.	–	–	–	–	–	–	–	–	See also table 2.
Corylus avellana	EUROPEAN HAZEL OR FILBERT	June	IBc – talc	5,000	–	–	–	–	Advantageous. (42)
Do.	do.	Summer	IAc – water	100	24	–	22	0	Softwood; spring hardwood cuttings root without treatment. (50)
atropurpurea	Purple	July	IAc – water	50	24	4	7	0	(66)
pendula	–	July	do.	200	24	4	13	0	(66)
Corylus sp.	FILBERT	July	IBc – talc	4,000	–	8	52	0	(76)
Cotoneaster adpressa	CREEPING COTONEASTER	Aug.	IBc – water	5–30	24	–	–	–	Not advantageous. (8)
C. apiculata	CRANBERRY COTONEASTER	June	do.	10–50	6	–	–	–	Do.
C. buxifolia	COTONEASTER	–	IAc – water	–	–	–	–	–	Slight advantage. (52)
C. dielsiana	DIELS COTONEASTER	July	IBc – water	5–20	24	–	–	–	Not advantageous. (8)
C. divaricata	SPREADING COTONEASTER	June, Aug.	IBc, IAc, or indolepropionate – water	10–100	6;21	–	–	–	Not advantageous; 21-hour treatment injurious. (8)

+ Symbols: IAc – indoleacetic acid; IBc – indolebutyric acid; IPc – indolepropionic acid; NAc – naphthaleneacetic acid; NAd – naphthalene acetamide; NBc – naphthalenebutyric acid

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HOTRICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Cotoneaster foveolata	GLOSSY COTONEASTER	July	IBc - water	5-20	24	-	-	-	Not advantageous. (8)
C. horizontalis	ROCK COTONEASTER	July, Aug.	do.	5-30	24	-	-	-	Do.
C. microphylla	ROCKSPRAY COTONEASTER	Oct.	do.	80	4	3	100	45	Hardwood cuttings. (88)
C. moupinensis	MOUPIN COTONEASTER	June, Aug.	do.	5-80	10;24	-	-	-	Not advantageous. (8)
C. racemiflora soongarica	SUNGARI REDBEAD COTONEASTER	Oct.	do.	20-80	24	5	1*	0*	Diluted Hormodin A. (57)
C. salicifolia	WILLOWLEAF COTONEASTER	Oct., Nov.	IAc - water	-	-	-	-	-	Diluted Hormodin A. (54)
C. simonsi	SIMONS COTONEASTER	Aug.	IBc - water	5-30	24	-	-	-	Diluted Hormodin A. (8)
C. zabeli	CHERRYBERRY COTONEASTER	June, July	do.	5-50	6;24	-	-	-	Not advantageous; 24-hour treatment injurious. (8)
Crataegus pyracantha	-	-	-	-	-	-	-	-	See *Pyracantha coccinea.*
Crataegus spp.	-	-	-	-	-	-	-	-	See table 2.
Cunonia capensis	CAPE CUNONIA; RED ALDER	-	IAc - water	100	22	-	-	-	Not advantageous. (43)
Cydonia japonica	-	-	-	-	-	-	-	-	See *Chaenomeles lagenaria.*
C. oblonga	"QUINCE A"	Sept.	IAc - water	25	24	5	60	20	(54)
Do.	"QUINCE B"	Sept.	do.	25	24	-	-	-	Slight advantage. (54)
Do.	"QUINCE C"	Sept.	do.	25	24	5	80	20	(54)
Do.	COMMON QUINCE	Spring	IBc - water	20	24	-	-	-	Advantageous when growing softwood cuttings used. (62)
Do.	do.	Feb.	IAc - lanolin	-	-	2	30	0	1.2 mg. IAc in lanolin applied under bark above basal cut. (24)
Cytisus canariensis	CANARY BROOM	Dec.	IBc - water	20	24	6	52*	0*	Diluted Hormodin A. (57)
Do.	do.	Mar.	do.	10	24	9	57*	47*	Do.
Do.	do.	Mar.	do.	40	24	9	65*	47*	Do.
ramosissimus (C. attleyanus)	do.	Sept.	IAc - water	200	24	5	90	10	(66)
C. maderensis	MADEIRA BROOM	-	do.	40	24	2	-	-	Softwood rooted after treatment, hardwood failed. (41)
Daphne cneorum	ROSE DAPHNE	July	IBc - water	10-80	10	-	-	-	Not advantageous. (8)
D. laureola	SPURGELAUREL DAPENE	Nov.	IAc - water	100	24	12	100	0	Some controls rooted later. (54)

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TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Daphne odora	WINTER DAPHNE	Aug.	IAc - water	200	-	5	60	-	Cuttings not rooted from Aug. treatment were retreated in Sept.; many rooted 1 week after second treatment. (85)
		Sept.	do.	200	-	1	66	-	
Deutzia crenata	-	-	-	-	-	-	-	-	See *D. scabra.*
D. corymbosa	HIMALAYA DEUTZIA	-	IAc - water	-	-	-	-	-	Slight advantage. (52)
D. gracilis	SLENDER DEUTZIA	Aug.	IBc - water	80-100	4	2	90	79	Easily rooted at any time. (88)
D. laxifolia	-	Oct.	do.	2.5	24	10	90*	80*	Diluted Hormodin A. (57)
D. lemoinei Hort.	LEMOINE DEUTZIA	July	do.	5-20	24	-	-	-	Not advantageous. (8)
D. lemoinei Lemoine	do.	Aug.	IAc - talc	1,000	-	4	40	20	(33)
D. scabra	FUZZY DEUTZIA	-	IAc - water	-	-	-	-	-	Not advantageous. (52)
Do.	do.	July	do.	100	24	3	-	-	20 percent more treated cuttings rooted. (81)
Do.	do.	July	NAc - water	100	24	3	-	-	Do.
Do.	do.	Nov.	NAc (potassium salt) - talc	1,000	-	9	100	78	Dormant cuttings. (31)
plena	Pride of Rochester	Oct.	IBc - water	5	24	6	78*	85*	Diluted Hormodin A. (57)
pleniflora	-	Nov.	do.	5	24	6	50*	55*	Do.
watereri	Waterer	Oct.	do.	10	24	3	38*	5*	Do.
D. setchuensis	-	-	-	-	-	-	-	-	See *D. corymbosa.*
Diervilla florida (Weigela florida, W. rosea)	OLD-FASHIONED WEIGELA	July	IAc - water	100	24	3	-	-	20 percent more treated cuttings rooted. (81)
Do.	do.	July	NAc - water	100	24	3	-	-	Do.
Do.	do.	-	IAc - water	100	-	4	55	20	(52)
Do.	do.	June	IBc - water	50	12	3	72	0	(7)
Do.	do.	Aug.	IAc - talc	1,000	-	7	27	13	Softwood cuttings. (33)
D. hybrida	-	Aug.	IBc - water	50	24	4	95	30	(7)
D. lonicera (D. trifida)	DWARF BUSHHONEYSUCKLE	Oct.	do.	20	24	3	50*	10*	Diluted Hormodin A. (57)
Elaeagnus angustifolia	RUSSIAN OLIVE	Oct.	do.	40	24	5	20*	0*	Do.
E. pungens	THORNY ELAEAGNUS	Oct.	do.	30	4	10	100	72	Earlier and later cuttings did not root. (88)

+ Symbols: IAc - indoleacetic acid; IBc - indolebutyric acid; IPc - indolepropionic acid; NAc - naphthaleneacetic acid; NAd - naphthalene acetamide; NBc - naphthalenebutyric acid

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Elaeagnus pungens var. *reflexa*	THORNY ELAEAGNUS	Oct.	IBc, IAc, or indolepropionate - water	100	21	-	-	-	Not advantageous. (8)
Enkianthus perulatus	WHITE ENKIANTHUS	July	IBc - water	90	8	7	100	100	(67)
Erica arborea									
alpina	ALPINE TREE HEATH	Sept.	NAc - water	100	24	2	-	-	50 percent more treated cuttings rooted. (81)
E. australis	SOUTHERN HEATH	Sept.	-do.	100	24	-	-	-	Slight advantage. (81)
E. caffra [*L. ?*]	HEATH	Dec.	IAc - water	100	24	-	-	-	Do.
E. darleyensis	DARLEY HEATH	July	IBc - water	10	8	4	100	77	(67)
E. melanthera	BLACKEYED HEATH	Dec.	NAc - water	100	24	8	-	-	72 percent more treated cuttings rooted. (81)
Do.	do.	Dec.	IAc - water	100	24	8	-	-	20 percent more treated cuttings rooted. (81)
E. multicaulis	HEATH	Sept., Oct.	NAc - water	100	24	-	-	-	Slight advantage. (81)
Do.	do.	Sept., Oct.	IAc - water	100	24	-	-	-	Do.
E. vagans	CORNISH HEATH	Sept.	NAc - water	100	24	-	-	-	20 percent more treated cuttings rooted. (81)
Do.	do.	Sept.	IAc - water	100	24	-	-	-	Do.
E. watsoni [*E. mackai* var. *watsoni ?*]	[watson ?]	Sept.	NAc - water	100	24	8	-	-	50 percent more treated cuttings rooted. (81)
Erica sp.	HEATH	-	IBc - water	40	24	-	-	-	Advantageous. (49)
Do.	do.	-	IBc - talc	12,000	-	-	-	-	Do.
Erinacea pungens	ERINACEA	Dec.	IAc - water	20	24	-	-	-	Not advantageous. (81)
Eriostemon sp.	ERIOSTEMON	-	do.	100	22	-	-	-	Not advantageous. (43)
Escallonia langleyensis	LANGLEY ESCALLONIA	July	NAc - water	100	24	-	-	-	50 percent more treated cuttings rooted. (81)
Do.	do.	July	IAc - water	100	24	-	-	-	Do.
Euonymus alata	WINGED EUONYMUS	June	IBc - water	10	18	7	76	44	(7)
E. europaea	EUROPEAN EUONYMUS	Aug.	do.	100	21	6	80	0	(8)
E. fortunei (*E. radicans*)	WINTERCREEPER EUONYMUS	-	IAc - water	100	-	3	76	28	(52)
Do.	do.	Aug.	IBc - water	100	21	5	80	65	(7)
colorata	Purpleleaf	June	do.	30	6	3	100	100	(7)
minima	Baby	Aug.	do.	100	24	6	100	87	(7)

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TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Euonymus fortunei vegeta	BIGLEAF WINTERCREEPER EUONYMUS	Aug.	IBc – water	100	21	5	80	65	(7)
E. japonica	EVERGREEN EUONYMUS	Mar.	do.	10	24	3	43*	0*	Diluted Hormodin A. (57)
E. patens	EUONYMUS	Oct.	do.	50	4	2	91	40	Easily rooted; earlier cuttings respond similarly. (88)
Do.	do.	July	do.	10	24	4	100	16	(7)
Euonymus sp.	do.	–	Indolebutyrate – vapor	–	½	–	–	–	Treatment advantageous. (89)
Do.	do.	Jan.	IAc – water	50	24	2	100	0	(85)
Euphorbia pulcherrima	POINSETTIA	June	IBc – water	20	24	3	70*	23*	Diluted Hormodin A; hardwood cuttings. (57)
Do.	do.	June	do.	15	24	3	51*	33*	Diluted Hormodin A; softwood cuttings. (57)
Do.	do.	Jan.	do.	–	24	–	–	–	Diluted Hormodin A; not advantageous. (57)
Do.	do.	May	do.	40	24	4	–	–	Treated averaged more and longer roots. (45)
E. splendens (E. mili)	CROWN OF THORNS	Mar.	do.	20	24	5	50*	23*	Diluted Hormodin A. (57)
Eurya japonica	EURYA	–	IAc – water	100	22	–	–	–	Not advantageous. (43)
Exochorda racemosa (E. grandiflora)	COMMON PEARLBUSH	July	IBc – water	10–80	10	–	–	–	Not advantageous. (8)
Fabiana imbricata	PERU FALSEHEATH	–	IAc – water	–	12–24	–	–	–	Advantageous; IAc alone better than 3 commercial products tried. (15)
Feijoa sellowiana	PINEAPPLE GUAVA	Jan.	do.	100	24	–	–	–	Not advantageous. (81)
Feijoa sp.	do.	–	do.	100–250	48–60	–	–	–	Rooting hastened. (84)
Ficus spp.	–	–	–	–	–	–	–	–	See table 2.
Fontanesia fortunei	FORTUNE FONTANESIA	Oct.	IBc – water	20	24	9	53*	0*	Diluted Hormodin A. (57)
Forsythia intermedia	BORDER FORSYTHIA	–	IAc – water	–	–	–	–	–	Not advantageous. (52)
Do.	do.	July	IBc – water	40	24	6	60	0	(61)
Do.	do.	June	do.	40	24	5	20	0	(61)
primulina	Primrose	Oct.	do.	20	24	3	60*	20*	Diluted Hormodin A. (57)
Do.	do.	Oct.	do.	10	24	9	77*	30*	Do.
spectabilis	Showy	Oct.	do.	10	24	3	70*	45*	Do.
F. suspensa	WEEPING FORSYTHIA	–	IAc – water	–	–	–	–	–	Slight advantage. (52)

+ Symbols: IAc – indoleacetic acid; IBc – indolebutyric acid; IPc – indolepropionic acid; NAc – naphthaleneacetic acid; NAd – naphthalene acetamide; NBc – naphthalenebutyric acid

TABLE 3.-*Broadleaf Shrubs*- Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Forsythia suspensa	WEEPING FORSYTHIA	June	NAc - water	100	24	-	-	-	Rooting hastened. (81)
Do.	do.	June	IAc - water	100	24	-	-	-	Do.
Do.	do.	June	IBc - water	50	6	4	80	40	(7)
Fortunella hindsi	HONG KONG KUMQUAT	Feb., Mar.	IAc - water	200	24	8	40	40	Treated cuttings produced more and longer roots. (13)
Fortunella sp.	KUMQUAT	Dec.	do.	200	-	3	0	0	Cuttings treated in Dec. were re-treated in Jan.; many rooted 2 weeks after second treatment. (85)
		Jan.	do.	200	-	2	70	0	
Fothergilla gardeni (F. alnifolia)	DWARF FOTHERGILLA	July	do.	200	24	6	100	100	(66)
Franklinia alatamaha	FRANKLINIA	Aug.	IBc - water	30	4	4	100	0	(88)
Fuchsia hybrida (F. speciosa)	COMMON FUCHSIA	Jan.	do.	5	24	5	87*	5*	Diluted Hormodin A. (57)
Do.	do.	Mar.	do.	10	24	3	75*	5*	Do.
Do.	do.	Feb.	do.	5	26	2	82*	2*	Do.
F. magellanica (F. macrostemma)	MAGELLAN FUCHSIA	Sept.	NAc - water	25	24	3	-	-	80 percent more treated cuttings rooted. (81)
Do.	do.	Sept.	IAc - water	25	24	3	-	-	Do.
Galphimia brasiliensis (Thryallis brasiliensis)	BRAZIL THRYALLIS	Dec.	do.	100	22	3	90	70	Treated cuttings produced many more roots. (43)
Gardenia jasminoides	CAPE JASMINE	-	do.	-	12-24	-	-	-	Advantageous; IAc alone better than 3 commercial products tried. (15)
veitchi	Veitch	Mar.	IBc - water	5	24	6	23*	0*	Diluted Hormodin A. (57)
Gardenia sp.	GARDENIA	-	do.	40	24	-	-	-	Advantageous. (49)
Do.	do.	-	IBc - talc	2,000	-	-	-	-	Do.
Do.	do.	July	IAc - water	200	24	4	100	0	(85)
Gordonia alatamaha	-	-	-	-	-	-	-	-	See *Franklinia alatamaha*.
Griselina lucida	GRISELINA	-	IAc - water	100	22	-	-	-	Not advantageous. (43)
Hibiscus rosa-sinensis	CHINESE HIBISCUS	Jan.	IBc - water	20	24	6	35*	28*	Diluted Hormodin A. (57)
Do.	do.	Mar.	do.	40	24	5	41*	0*	Do.
H. syriacus	SHRUBALTHAEA; ROSE OF SHARON	-	do.	20-100	24	-	-	-	Advantageous; cuttings from dormant plants. (41)
Do.	do.	-	NAc - water	20-100	24	-	-	-	Do.
Do.	do.	-	IAc - water	40-200	24	-	-	-	Do.
Do.	do.	-	IBc - water	8-40	72	-	-	-	Do.

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.

§ Numbers in parentheses refer to literature citations, pp. 65-68.

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Hibiscus syriacus	SHRUBALTHAEA; ROSE OF SHARON	July	IBc – water	50	6	5	100	52	(8)
Hibiscus sp.	ROSEMALLOW	–	indoleacetate – vapor	–	½	–	–	–	Rooting excellent but shoots inhibited. (89)
Hydrangea arborescens	SMOOTH HYDRANGEA	Nov.	Naphthyl-hexoic acid (potassium salt) – talc	1,000	–	11	87	37	Dormant cuttings. (31)
H. macrophylla (H. hortensis, H. opuloides)	BIGLEAF HYDRANGEA	Oct.	IAc – water	200	20	2	66	0	(85)
Do.	do.	Oct.	do.	50	24	–	–	–	10 percent more treated cuttings rooted. (81)
Do.	do.	June	IBc – water	10	24	4	73*	25*	Diluted Hormodin A. (57)
otaksa	Otaksa	July	IAc – water	200	24	4	100	100	(66)
H. paniculata	PANICLE HYDRANGEA	June	IBc – water	20	24	4	100	40	(61)
H. quercifolia	OAKLEAF HYDRANGEA	July	do.	30	10	7	40	0	(7)
Do.	do.	July	IAc – water	200	24	4	100	33	(66)
H. sargentiana	SARGENT HYDRANGEA	July	do.	200	24	4	100	50	(66)
Hydrangea sp.	–	–	–	–	–	–	–	–	See also table 5.
Hymenanthera crassifolia	HYMENANTHERA	–	IAc – water	100	22	–	–	–	Not advantageous. (43)
Ilex coronata	HOLLY	June	IBc – water	30–80	4	9	30	0	Softwood best; no effect on Aug. cuttings. (88)
I. cornuta	CHINESE HOLLY	–	do.	40–80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
I. crenata	JAPANESE HOLLY	Aug.	IBc – water	30	24	7	53	0	(7)
Do.	do.	–	do.	20	24	3	100	–	Treated plants rooted sooner and in greater percentage. (41)
Do.	do.	–	NAc – water	50	24	3	100	–	Do.
Do.	do.	June	IBc – water	80	4	6	100	57	Hastened rooting; growing wood best. (88)
bullata	Convexleaf	–	do.	20	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
helleri	Heller	–	IBc – water	20	24	–	–	–	Do.
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
latifolia	Bigleaf	Aug.	IBc – water	100	20	–	–	–	Not advantageous. (8)
microphylla	Littleleaf	June	do.	50	4	9	87	20	Best results with actively growing wood. (88)

+ Symbols: IAc – indoleacetic acid; IBc – indolebutyric acid; IPc – indolepropionic acid; NAc – naphthaleneacetic acid; NAd – naphthalene acetamide; NBc – naphthalenebutyric acid

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Ilex crenata	JAPANESE HOLLY								
nummularia	Boxleaf	–	IBc – water	20	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
I. glabra	INKBERRY; WINTERBERRY	July	IBc – water	50	24	4	96	4	(7)
Do.	do.	–	do.	20	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
I. pernyi	PERNY HOLLY	–	IBc – water	40;80	–	–	–	–	Do.
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
I. verticillata	COMMON WINTERBERRY	–	IAc – water	–	–	–	–	–	Slightly advantageous. (52)
Do.	do.	–	IBc – water	40;80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Do.	do.	Oct., Nov.	IAc – water	–	–	–	–	–	Not advantageous. (54)
Ilex spp.	–	–	–	–	–	–	–	–	See also table 2.
Jasminum beesianum	BEES JASMINE	July	IAc – water	100	24	4	100	50	(66)
J. mesnyi (J. primulinum)	PRIMROSE JASMINE	July	do.	200	24	10	100	40	(66)
J. nudiflorum	WINTER JASMINE	July	do.	200	24	4	73	40	(66)
Do.	do.	–	IAc – lanolin	5,000	–	5	68	16	(52)
J. stephanense	STEPHAN JASMINE	–	IAc – water	–	–	–	–	–	Not advantageous. (66)
J. wallichianum [*J. humile* ?]	JASMINE	July	do.	100	24	4	100	20	(66)
Jasminum sp.	do.	Mar.	IAc – water	100	24	5	100	0	(85)
Kalmia angustifolia	LAMBKILL KALMIA	July, Aug.	do.	100	24	–	–	–	Cuttings died. (16)
K. latifolia	MOUNTAINLAUREL KALMIA	Mar.	do.	50	48	–	–	–	Not advantageous. (81)
Do.	do.	July	IBc – water	90	24	19	80	20	Leaves. (67)
Do.	do.	July	IAc – water	90	24	18	40	20	Stems. (67)
myrtifolia	Myrtleleaf	Jan.	do.	100	48	–	66	12	(81)
Kerria japonica	JAPANESE KERRIA	July	do.	33.3	24	–	–	–	Hastened rooting slightly. (81)
Kolkwitzia amabilis	BEAUTYBUSH	June	IBc – water	80	10	6	92	4	(7)
Do.	do.	July	do.	60–100	4	5	100	0	Cuttings taken before terminal buds formed. (88)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65–68.

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Kolkwitzia amabilis	BEAUTYBUSH	Oct.	IBc – water	10–40	24	9	4*	0*	Diluted Hormodin A. (57)
Lantana camara	COMMON LANTANA	Dec.	do.	5	24	3	67*	6*	Do.
Do.	do.	Jan.	do.	10	24	4	52*	0*	Do.
Do.	do.	Oct.	do.	10	24	3	50*	5*	Do.
Do.	do.	Feb.	do.	10	24	4	82*	62*	Do.
L. sellowiana	TRAILING LANTANA	Feb.	do.	10	24	4	90*	75*	Do.
Do.	do.	Feb.	do.	5	24	4	55*	72*	Do.
Do.	do.	Feb.	do.	5	24	4	30*	5*	Do.
Do.	do.	Oct.	do.	5	24	2	47*	2*	Do.
Do.	do.	Dec.	do.	10	24	3	92*	26*	Do.
Lantana sp.	LANTANA	Mar.	IAc – lanolin	500	–	4	–	–	10 mg. per treatment; treated cuttings averaged 26 roots and controls 3. (11)
Do.	do.	Mar.	do.	500	–	7	–	–	10 mg. per treatment; treated cuttings averaged 37 roots and controls 25. (11)
Leucothoe catesbaei	CATESBY'S LEUCOTHOE; DROOPING LEUCOTHOE	July	IBc – water	10	24	7	100	100	Leaves. (67)
Do.	do.	July	do.	10	24	10	100	100	Stems. (67)
Ligustrum amurense	AMUR PRIVET	July	IBc – water	80	24	4	67*	30*	Diluted Hormodin A; hardwood cuttings. (57)
Do.	do.	Oct.	do.	40	24	6	83*	65*	Diluted Hormodin A; soft tips. (57)
L. ibolium	IBOLIUM PRIVET	July	do.	50	6	5	76	72	(7)
L. ibota regelianum (L. regelianum)	REGELS BORDER PRIVET	June	do.	50	6	7	93	87	(7)
Do.	do.	Oct.	do.	80	24	6	17*	0*	Diluted Hormodin A. (57)
Do.	do.	Nov.	do.	80	24	6	75*	0*	Do.
L. japonicum	JAPANESE PRIVET	June	do.	30–50	20	4	95	94	Growing tips rooted much sooner than older wood. (88)
L. obtusifolium	–	–	–	–	–	–	–	–	See *L. ibota.*
L. ovalifolium	CALIFORNIA PRIVET	–	IBc – water	80	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
L. regelianum	–	–	–	–	–	–	–	–	See *L. ibota* var. *regelianum.*
L. vulgare	EUROPEAN PRIVET	July	IBc – water	30	5	5	64	16	(7)

+ Symbols: IAc – indoleacetic acid; IBc – indolebutyric acid; IPc – indolepropionic acid; NAc – naphthaleneacetic acid; NAd – naphthalene acetamide; NBc – naphthalenebutryic acid

TABLE 3.--*Broadleaf Shrubs*--Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Ligustrum vulgare	EUROPEAN PRIVET								
atrovirens	Darkgreen	-	IAc - lanolin	5,000	-	3	20	5	Rooted in sand. (52)
Do.	do.	-	do.	5,000	-	3	58	0	Rooted in water. (52)
foliosa	EUROPEAN PRIVET	Oct.	IBc - water	80	24	6	36*	0*	Diluted Hormodin A. (57)
lowdense	do.	Nov.	do.	80	24	6	75*	7*	Do.
Do.	do.	Oct.	do.	40	24	10	80*	25*	Do.
Ligustrum sp.	PRIVET	-	Naphthalene-acetate vapor	-	½	-	-	-	Advantageous. (89)
Lindera benzoin	-	-	-	-	-	-	-	-	See *Benzoin*.
Lonicera bella	BELLE HONEYSUCKLE								
albida	White	Oct.	IBc - water	2.5	24	5	67*	0*	Diluted Hormodin A; coarse sand rooting medium. (57)
Do.	do.	Nov.	do.	10-80	24	6	0*	22*	Diluted Hormodin A; sand and peat rooting medium. (57)
L. korolkowi	BLUELEAF HONEYSUCKLE	Nov.	IAc - water	100	40	8	80	50	(7)
L. nitida	BOX HONEYSUCKLE	Nov., Dec.	do.	100	24	5	-	-	Treated cuttings died, controls rooted. (16)
L. standishi	STANDISH HONEYSUCKLE	Oct.	IBc - water	2.5	24	10	27*	17*	Diluted Hormodin A. (57)
L. tatarica	TATARIAN HONEYSUCKLE	Mar.	IAc - water	100	24	5	50	3	Treated cuttings produced more and longer roots. (37)
Do.	do.	Mar.	do.	50-100	24	5	88	38	(28)
Do.	do.	Nov.	IAc - talc	1,000	-	6	47	28	Taken from dormant plants. (33)
Do.	do.	Nov.	IBc - talc	500	-	7	-	-	Advantageous; more and longer roots. (30)
Do.	do.	Nov.	NAc (potassium salt) - talc	1,000	-	7	69	0	(31)
L. yunnanensis	YUNNAN HONEYSUCKLE	Dec.	IAc - water	50	24	3	-	-	40 percent more treated cuttings rooted. (81)
Do.	do.	Jan.	NAc - water	50	24	4	-	-	65 percent more treated cuttings rooted. (81)
Lonicera sp.	-	-	-	-	-	-	-	-	See also table 5.
Magnolia hybrida var. *norbertiana* [*M. soulangeana* var. *norbertiana* ?]	[SAUCER MAGNOLIA?]	July	IAc - water	100	24	6	100	37	(66)
M. liliflora	LILY MAGNOLIA	Aug.	IBc - water	50	22	7	100	21	Terminal buds immature when cuttings taken. (88)
M. soulangeana	SAUCER MAGNOLIA	July	IAc - water	200	24	6	67	0	(66)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65-68.

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Magnolia spp.	-	-	-	-	-	-	-	-	See also table 2.
Mahoberberis neuberti latifolia	MAHOBERBERIS	Aug.	IBc, IAc, or indole-propionate - water	50-100	24	-	-	-	Not advantageous. (8)
Malus spp.	-	-	-	-	-	-	-	-	See *Pyrus*, table 2.
Maurocenia capensis	HOTTENTOT CHERRY	-	IAc - water	100	22	-	-	-	Not advantageous. (43)
Melastoma sp.	MELASTOMA	May	NAc or NAd - talc	1,000	-	1	100	100	(73)
Menziesia ciliicalyx	MENZIESIA; SKUNK-BUSH	July, Aug.	IAc - water	100	30	4	-	-	Not advantageous. (16)
Myrica caroliniensis [Auth., or Mill.?]	[NORTHERN BAYBERRY, OR SOUTHERN WAXMYRTLE ?]	Aug.	IBc, IAc, or indole-propionate - water	50-100	24	-	-	-	Not advantageous. (8)
M. gale	SWEETGALE	July	IAc - water	100	24	5	100	60	(66)
Myrica sp.	-	-	-	-	-	-	-	-	See also table 2.
Myrtus pubescens	MYRTLE	Dec.	IAc - water	100	22	5	58	0	(43)
M. ugni	-	-	-	-	-	-	-	-	See *Ugni molinae*.
Nerium oleander	COMMON OLEANDER	Mar.	IBc - water	10	24	5	40*	3*	Diluted Hormodin A. (57)
Do.	do.	Jan.	do.	20	24	6	60*	38*	Do.
Olearia haastii	HAAST DAISYBUSH	Nov.	IAc - water	25	28	5	80	30	(54)
Opuntia sp.	PRICKLYPEAR; CHOLLA	-	IBc - water	20	24	-	-	-	Advantageous. (49)
Osmanthus ilicifolius (*O. aquifolium*)	HOLLY OSMANTHUS	July	do.	150	4	5	93	20	(88)
Do.	do.	Dec.	IAc - water	100	22	6	100	55	Treatment increased number of roots. (43)
Pernettya leucocarpa	PERNETTYA	July, Aug.	do.	100	30	4	-	-	Not advantageous. (16)
Philadelphus coronarius	SYRINGA; SWEET MOCKORANGE	-	IAc - lanolin	5,000	-	36	52	25	(52)
Do.	do.	July	IBc - water	50	20	2	56	8	(7)
Do.	do.	Oct.	do.	20	24	9	87*	47*	Diluted Hormodin A. (57)
P. grandiflorus	BIG SCENTLESS MOCKORANGE	July	do.	30-50	20	5	75	70	Softwood cuttings taken soon after flowering. (88)
Philadelphus sp.	MOCKORANGE Norma	July	do.	30	4	5	87	0	Do.

+ Symbols: IAc - indoleacetic acid; IBc - indolebutyric acid; IPc - indoleproprionic acid; NAc - naphthaleneacetic acid; NAd - naphthalene acetamide; NBc - naphthalenebutryic acid

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Philadelphus sp.	MOCKORANGE								
Do.	Virginal	Oct.	IBc - water	20	24	9	96*	15*	Diluted Hormodin A. (57)
Do.	Voie Lactee	July	do.	80	8	5	42	10	Softwood cuttings taken soon after flowering. (88)
Photinia villosa	PHOTINIA	July	IAc - water	50	24	4	10	0	(66)
Physocarpus opulifolius	COMMON NINEBARK	Nov.	IBc - water	50	40	8	90	80	(7)
Do.	do.	-	IAc - water	-	-	-	-	-	Slightly advantageous. (52)
Pieris floribunda	MOUNTAIN PIERIS	July	IBc - water	10	8	20	20	0	(67)
P. japonica	JAPANESE PIERIS	July	do.	90	8	16	90	60	Leaves. (67)
Do.	do.	July	do.	90	8	6	100	80	Stems. (67)
Do.	do.	-	do.	20	24	-	-	-	Advantageous. (49)
Do.	do.	-	IBc - talc	2,000	-	-	-	-	Do.
Pittosporum dalli	DALLS PITTOSPORUM	Aug.	IAc - water	100	24	-	10	0	(81)
Poinsettia sp.	-	-	-	-	-	-	-	-	See *Euphorbia pulcherrima.*
Potentilla fruticosa	BUSH CINQUEFOIL	Aug.	IAc - water	100	24	1	50	0	(52)
Do.	do.	Oct.	IBc - water	10	24	9	40*	23*	Diluted Hormodin A. (57)
Prunus japonica [Thunb. or Hort ?]	[DWARF FLOWERING CHERRY? FLOWERING ALMOND? CHINESE BUSHCHERRY?]	June	Rootone (dust)	-	-	9	12-82	0-52	Lower cuttings responded best; softwood. (56)
Do.	do.	June	IBc - water	22	20	9	70	33	Softwood; diluted Auxilin 3; lower cuttings responded best. (56)
P. nana [Stokes, Hort., or DuRoi?]	[RUSSIAN ALMOND?]	June	do.	22	20	-	0	0	Diluted Auxilin 3; Rootone produced similar results; softwood. (56)
P. triloba	FLOWERING PLUM	June	Rootone (dust)	-	-	9	0	0	Softwood cuttings. (56)
Do.	do.	June	IBc - water	22	20	9	7-57	0	Softwood; diluted Auxilin 3; middle cuttings responded best. (56)
plena	do.	July	do.	22	20	-	56	0	Softwood stem cuttings; diluted Auxilin 3; leaf-bud cuttings did not root with or without treatment. (55)
Do.	do.	July	do.	50-100	4	4	33	0	Terminal buds mature when cuttings taken; slightly better results from younger wood. (87)
Prunus sp.	NEWPORT PLUM	July	do.	22	20	-	7	0	Diluted Auxilin 3; leaf-bud cuttings. (55)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65-68.

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Prunus spp.	–	–	–	–	–	–	–	–	See also table 2.
Pyracantha coccinea	SCARLET FIRETHORN	Oct.	IBc – water	30	4	10	81	45	Nearly mature cuttings; July and Aug. cuttings failed. (88)
gibbsi	–	Oct.	do.	40	24	5	40*	35*	Dilnted Hormodin A. (57)
pauciflora	SPARSE FIRETHORN	Nov.	IAc – water	50	24	7	75	60	(7)
P. crenulata	NEPAL FIRETHORN	Sept.	do.	50	20	5	100	0	(54)
Rhamnus frangula	GLOSSY BUCKTHORN	July	IBc – water	5–20	24	–	–	–	Not advantageous. (8)
RHODODENDRON SUBGENUS *AZALEA*									
Rhododendron arborescens	SWEET OR SMOOTH AZALEA	June	do.	80–100	4	9	60	70	Cuttings taken when wood in active growth. (88)
Do.	do.	July	IBc – talc	5,000	–	5	100	0	Leaf-mallet cuttings. (49)
Do.	do.	May	do.	12,000	–	6	100	25	Do.
grandiflorum	do.	June	do.	12,000	–	5	75	25	Do.
R. calendulaceum	FLAME AZALEA	June	IBc – water	50–100	22	10	40	0	Cuttings taken while wood in active growth; older wood of decidnous azaleas did not root. (88)
Do.	do.	May	IBc – talc	12,000	–	8	75	25	Leaf-mallet cuttings. (49)
R. canadense	RHODORA	June	do.	12,000	–	13	25	0	Do.
R. canescens	PIEDMONT AZALEA	June	do.	12,000	–	13	75	0	Do.
R. gandavense	GHENT AZALEA	June	do.	12,000	–	7	75	0	Do.
Do.	Bonquet de Flore	June	IBc – water	10	10	13	80	80	(67)
Do.	Domenico Scassi	June	do.	90	10	18	60	40	(67)
Do.	Gloria Mundi	June	do.	90	10	20	71	57	(67)
Do.	Grandeur Triomphant	June	do.	90	10	15	100	0	(67)
Do.	Pucelle	June	do.	90	10	18	100	60	(67)
Do.	Reine Louise	June	do.	90	10	18	83	60	(67)
Do.	Rosetta	June	do.	10	10	15	100	80	(67)
Do.	Ruddy Ghent	June	do.	10	10	21	17	50	(67)
Do.	Souvenir de President Carnot	June	do.	10	10	20	17	50	(67)
Do.	Unique	June	do.	90	10	22	50	20	(67)

+ Symbols: IAc – indoleacetic acid; IBc – indolebutyric acid; IPc – indoleproprionic acid; NAc – naphthaleneacetic acid; NAd – naphthalene acetamide; NBc – naphthalenebutryic acid

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
R. japonicum [Schneid. or Suring ?]	JAPANESE AZALEA	June	IBc - water	50-100	4	9	35	0	(88)
Do.	do.	July	IAc - water	200	24	6	13	0	(66)
Do.	do.	June	IBc - water	10	24	11	90	60	(67)
aureum	GOLDEN JAPANESE AZALEA	June	do.	90	10	9	100	100	Rooting hastened; more roots per cutting. (67)
R. kaempferi	-	-	-	-	-	-	-	-	See *R. obtusum* var. *kaempferi*.
R. ledifolium	-	-	-	-	-	-	-	-	See *R. mucronatum*.
R. maxwelli	AZALEA	June	IBc - water	30-80	20	7	100	82	(88)
R. molle [Miq., or Don ?]	do.	July	IBc - talc	2,000	-	10	50	0	Leaf-mallet cuttings; June cuttings rooted half as well. (49)
R. molle	Compte de Gomer	June	IBc - water	-	-	-	-	-	No effective treatment found. (67)
Do.	Elizabeth	June	do.	90	10	10	40	25	(67)
Do.	Frere Orban	June	do.	90	10	10	100	20	(67)
Do.	General Brailmont	June	do.	90	10	8	100	100	Treated cuttings produced more roots. (67)
Do.	Mignon	June	do.	90	10	9	100	100	Hastened rooting. (67)
albicans	AZALEA	June	do.	90	10	10	100	0	(67)
R. (Azalea mollis [Hort. or Blume?])	AZALEA	June	do.	30-100	4	10	70	10	(88)
R. mucronatum	SNOW AZALEA	July	IBc - water	10	24	5	100	90	(67)
Do.	do.	May	IBc - talc	2,000	-	5	100	100	Leaf-mallet cuttings. (49)
R. nudiflorum	AZALEA, PINXTER FLOWER	June	IBc - water	80-100	4	9	73	56	Taken from actively growing wood. (88)
R. obtusum	Firefly	July	do.	30-100	18	8	95	94	(88)
Do.	Hexe	Jan.	IAc - water	50	8	4	85	40	(43)
Do.	Hinomayo	June	IBc - water	50-80	20	6	81	66	(88)
Do.	Yayegiri	July	do.	50	4	7	100	67	(88)
hinodigiri	AZALEA	June	IBc - talc	2,000	-	4	100	75	Leaf-mallet cuttings. (49)
Do.	do.	July	IBc - water	30-100	20	7	85	75	(88)
kaempferi	do.	June	IBc - talc	2,000	-	5	100	25	Leaf-mallet cuttings. (49)
Do.	do.	July	IBc - water	50-80	4	7	85	0	Taken from actively growing twigs. (88)
Do.	do.	Aug.	do.	90	8	4	100	100	Rooting hastened; more roots per cutting. (67)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.

§ Numbers in parentheses refer to literature citations, pp. 65-68.

TABLE 3.-*Broadleaf Shrubs*- Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Rhododendron poukhanense	-	-	-	-	-	-	-	-	See *R. yedoense* var. *poukanense*.
R. pulchrum									
maxwelli	AZALEA	July	IBc - water	90	24	5	100	100	Treated cuttings produced more roots. (67)
R. reticulatum	ROSE AZALEA	July	do.	40	8	5	100	100	Do.
R. schlippenbachi	ROYAL AZALEA	May	IBc - talc	12,000	-	11	75	0	Leaf-mallet cuttings. (49)
R. vaseyi	PINKSHELL AZALEA	June	do.	2,000	-	11	75	0	Leaf-mallet cuttings. (49)
Do.	do.	June	IBc - water	10	8	15	60	30	(67)
R. viscosepalum	CHINESE SWAMP AZALEA								
daviesi	Davies	June	do.	90	10	10	100	80	(67)
R. viscosum	SWAMP AZALEA	June	do.	80	4	9	58	63	(88)
Do.	do.	June	IBc - talc	15,000	-	7	50	0	Leaf-mallet cuttings. (49)
Do.	do.	July	IBc - water	90	24	4	100	100	Treated cuttings produced more roots. (67)
R. yedoense									
poukhanense	KOREAN YODOGAWA AZALEA	July	IBc - talc	2,000	-	3	100	25	Leaf-mallet cuttings. (49)
Do.	do.	June	do.	2,000	-	4	100	0	Do.
Do.	do.	June	IBc - water	80-100	4	9	67	57	Taken from actively growing wood. (88)
Rhododendron (Azalea) spp. hort. varieties	-	-	-	-	-	-	-	-	See also at end of *Eu-Rhododendron*.
RHODODENDRON SUBGENUS *EU-RHODODENDRON*									
Rhododendron altaclarense									
veitchi	RHODODENDRON	June	IBc - water	-	-	-	0	0	(67)
R. catawbiense	CATAWBA RHODODENDRON	July	do.	80	24	18	100	90	Leaves. (67)
Do.	do.	Aug.	do.	10	8	12	100	80	Stems. (67)
R. collettianum	COLLET RHODODENDRON	June	IBc - talc	12,000	-	-	50	0	Leaf-mallet cuttings. (49)
R. dauricum (R. dahuricum)	DAHURIAN RHODODENDRON	July	do.	5,000	-	8	100	25	Do.
mucronulatum	-	-	-	-	-	-	-	-	See *R. mucronulatum*.
sempervirens	EVERGREEN DAHURIAN RHODODENDRON	June	IBc - water	90	10	21	80	80	(67)

+ Symbols: IAc - indoleacetic acid; IBc - indolebutyric acid; IPc - indoleproprionic acid; NAc - naphthaleneacetic acid; NAd - naphthalene acetamide; NBc - naphthalenebutryic acid

TABLE 3.-*Broadleaf Shrubs*- Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
R. dauricum (R. dahuricum)									
sempervirens	EVERGREEN DAHURIAN RHODODENDRON	July	IAc - water	50	24	4	33	0	(66)
R. decorum	SWEETSHELL RHODODENDRON	July	IBc - water	80	24	9	100	20	Leaves. (67)
R. lutescens	CANARY RHODODENDRON	July, Aug.	IAc - water	100	24	-	-	-	Cuttings died. (16)
R. maximum	GREAT LAUREL; ROSEBAY RHODODENDRON	July	IBc - water	90	24	13	100	20	(67)
roseum	PINK ROSEBAY RHODODENDRON	July	IBc - talc	12,000	-	10	50	0	Leaf-mallet cuttings. (49)
Do.	do.	July	IBc - water	80	8	16	40	0	(67)
R. micranthum	MANCHURIAN RHODODENDRON	July	do.	10	8	13	100	60	(67)
R. minus	PIEDMONT RHODODENDRON	July	do.	90	24	16	90	100	Hastened rooting; leaves. (67)
Do.	do.	July	do.	90	8	14	40	20	Stems. (67)
R. mixtum (hybrids of *R. rustica*)	CHINAGHENT RHODODENDRON								
	Apelles	June	Do.	90	10	22	80	0	(67)
Do.	Il Tasso	June	do.	90	10	20	100	20	(67)
Do.	Phoebe	June	do.	90	10	20	60	20	(67)
R. mucronulatum	KOREAN RHODODENDRON	June	IBc - talc	12,000	-	7	75	0	Leaf-mallet cuttings. (49)
Do.	do.	Aug.	IAc or indolepropionate - water	100	21	-	-	-	Injurious. (8)
R. myrtilloides	PINCUSHION RHODODENDRON	July, Aug.	IAc - water	100	24	-	-	-	Cuttings died. (16)
R. ponticum	PONTICUM RHODODENDRON	July	IBc - water	40	24	9	80	80	Treated cuttings produced more roots. (67)
Do.	do.	July	do.	40	8	8	100	80	Leaves. (67)
R. racemosum	MAYFLOWER RHODODENDRON	July	do.	90	24	11	100	100	Treated produced more roots. (67)
R. roseum	-	-	-	-	-	-	-	-	See *R. maximum* var. *roseum*.
Rhododendron and *Azalea* spp.									
	Carmen	June	IBc - water	30-100	4	6	100	30	Taken while twigs actively growing. (88)

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TABLE 3.-*Broadleaf Shrubs*- Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Rhododendron and *Azalea* spp.	Cattleya	Aug.	IBc - water	50-100	4	5	79	0	Short laterals better than main branches. (88)
Do.	Christmas Cheer	June	do.	50	4	6	60	100	(88)
Do.	do.	June	IBc - talc	2,000	-	5	100	100	Leaf-mallet cuttings. (49)
Do.	Coral Bells	June	do.	2,000	-	5	100	100	Do.
Do.	Damask Rose	July	IBc - water	30-80	4	5	95	65	Short laterals better than main branches. (88)
Do.	Debutante	June	do.	50	4	5	89	61	(88)
Do.	Flame	June	IBc - talc	2,000	-	5	100	100	Leaf-mallet cuttings. (49)
Do.	Pink Pearl	June	do.	2,000	-	5	100	100	Do.
Do.	Snow	June	IBc - water	30	21	8	80	33	(88)
Do.	do.	June	IBc - talc	2,000	-	5	100	100	Leaf-mallet cuttings. (49)
Rhodotypos kerriodes (*R. scandens*)	BLACK JETBEAD	July	IBc - water	22	20	-	33	0	Diluted Auxilin 3; leaf-bud cuttings. (55)
Do.	do.	July	do.	10	24	4	76	0	(7)
Ribes alpinum	ALPINE CURRANT	June	do.	80	12	5	44	0	(7)
variegatum	do.	July	do.	22	20	-	92	60	Diluted Auxilin 3; softwood cuttings. (55)
R. grossularia (*R. uva-crispa*)	EUROPEAN GOOSEBERRY	Oct.	NAc - water	100	24	-	-	-	20 percent more cuttings rooted; more roots per cutting. (81)
Rosa blanda x *R. multiflora*	-	-	-	-	-	-	-	-	See *R. multiflora* x *R. blanda*.
R. canina	DOG ROSE Senff's	June	IAc - water	20	24	-	7	0	Softwood cuttings. (6)
Do.	do.	Dec.	do.	100	24	-	54	58	Hardwood cuttings. (6)
R. ecae Aitch.	ECA ROSE	July	do.	20	24	4	67	25	(66)
R. indica									
odorata	TEA ROSE	Nov.	IBc - water	2.5	24	3	25*	0*	Diluted Hormodin A. (57)
Do.	do.	Nov.	do.	5	24	3	48*	15*	Do.
Do.	do.	Nov.	do.	5	24	6	33*	55*	Do.
Do.	do.	Nov.	do.	5	24	4	85*	0*	Do.
R. manetti	CHINA ROSE; BENGAL ROSE	Mar.	do.	10	24	3	63*	15*	Do.
R. moschata									
floribunda	MUSK ROSE	Dec.	IAc - water	20	24	-	16	84	Hardwood cuttings. (6)

+ Symbols: IAc - indoleacetic acid
IBc - indolebutyric acid
IPc - indoleproprionic acid
NAc - naphthaleneacetic acid
NAd - naphthalene acetamide
NBc - naphthalenebutryic acid

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Rosa multiflora	JAPANESE ROSE	Summer, fall	IBc - talc	2,000	-	-	-	-	Response favorable when temperature of 65°-75° F. maintained. (48)
Do.	do.	Summer, fall	IBc - water	5-10	24	-	-	-	Do.
Do.	Chenaults	Oct.	do.	2.5	24	10	20*	20*	Diluted Hormodin A. (57)
Do.	Climbing American Beauty	Oct.	do.	2.5	24	9	25*	13*	Do.
Do.	Dorothy Perkins	Oct.	do.	10	24	3	80*	43*	Do.
Do.	Excelsa	Apr.	do.	20	24	6	43*	30*	Do.
Do.	Seabrook's	Dec.	IAc - water	20	24	-	64	18	Hardwood cuttings. (6)
Do.	Tausend Schoen	Oct.	IBc - water	10	24	4	28*	0*	Diluted Hormodin A. (57)
Do.	(unidentified)	June	IAc - water	20	24	-	80	60	Softwood cuttings. (6)
R. multiflora x *R. blanda*	ROSE	Oct.	IBc - water	5	24	3	38*	0*	Diluted Hormodin A. (57)
R. odorata Sweet	TEA ROSE	June	do.	30-100	18	2	95	89	Easily rooted at any time. (88)
R. omeiensis	OMEI ROSE								
pterocantha	-	-	-	-	-	-	-	-	See *R. sericea* var. *pterocantha*.
R. polyantha	POLYANTHA ROSE								
	Kluis' Scarlet	Apr.	IBc - water	5	24	5	97*	19*	Diluted Hormodin A. (57)
R. sericea									
pteracantha	WINGTHORN OMEI ROSE	July	IAc - water	20	24	4	27	0	(66)
R. willmottiae	WILLMOTT ROSE	Dec.	do.	20	24	-	0	0	Hardwood cuttings. (6)
Rosa sp.	ROSE								
	Dizzy Bee	Jan.	do.	200	24	3	100	0	(85)
Do.	Ellen Poulsen	June	IBc - water	40	24	5	40	0	(61)
Do.	Kirsten Poulsen	Dec.	IAc - water	20	24	-	57	0	Hardwood cuttings. (6)
Do.	Paul's Scarlet Climber	Dec.	do.	100	24	-	24	26	Do.
Do.	(several climbers and creepers)	July, Aug.	IBc - water	5	24	-	-	-	Response favorable when temperature of 65°-75° F. maintained. (48)
Do.	do.	July, Aug.	IBc - talc	2,000	-	-	-	-	Do.

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TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Rosa sp.	ROSE								
Do.	(hybrid teas, garden varieties)	Aug.	IBc – water	2.5	24	–	–	–	Some advantage when temperature of 65°–75°F. maintained. (48)
Do.	do.	Aug.	IBc – talc	2,000	–	–	–	–	Do.
Do.	(hybrid teas, greenhouse varieties)	After flowering	IBc – water	1.25–2.5	24	2–3	–	–	Effective when temperature of 65°–75°F. maintained. (48)
Do.	do.	do.	IBc – talc	1,000–2,000	–	2–3	–	–	Do.
Rubus deliciosus	BOULDER RASPBERRY; ROCKY MOUNTAIN FLOWERING RASPBERRY	July	IBc – water	22	20	–	0	0	Diluted Auxilin 3; Leaf-bud cuttings. (55)
Salix discolor	PUSSY WILLOW	June	do.	50	12	3	72	36	(7)
S. glauca	GRAYLEAF WILLOW	July, Aug.	IAc – water	100	18	3	–	–	Rooting delayed. (16)
S. glauca x *S. cistus*	SILVER PINK WILLOW	July, Aug.	do.	100	18	4	–	–	Do.
S. incana (S. elaeagnos)	ELAEAGNUS WILLOW	June	IBc – water	10	6	3	96	60	(7)
Sambucus canadensis	AMERICAN ELDER	Nov.	NAc – talc	1,000	–	9	87	47	Dormant cuttings. (31)
S. racemosa	EUROPEAN RED ELDER								
laciniata	Cutleaf	July	IBc – water	22	20	–	100	80	Diluted Auxilin 3; leaf-bud cuttings, upper 3 nodes, lower nodes progressively poorer. (55)
Senecio cineraria	SILVER GROUNDSEL	Jan.	do.	10	24	4	60*	35*	Diluted Hormodin A. (57)
Do.	do.	Oct.	do.	5	24	2	45*	12*	Do.
S. greyi	GRAY'S GROUNDSEL	–	IAc – water	–	–	–	–	–	Slight improvement. (52)
Senecio sp.	–	–	–	–	–	–	–	–	See also table 5.
Serissa foetida	SERISSA	Spring	IAc – water	10	24	–	–	–	Advantageous. (77)
Skimmia sp.	SKIMMIA	Nov.	do.	100	8	3	90	30	More roots per cutting. (43)
Spiraea arguta	GARLAND SPIREA	Oct.	IBc – water	10	24	5	63*	8*	Diluted Hormodin A. (57)
S. billiardi	BILLIARD SPIREA	Oct.	do.	10	24	4	66*	16*	Do.
S. bumalda	BUMALDA SPIREA	Oct.	do.	5	24	9	65*	13*	Do.
S. prunifolia	BRIDALWREATH SPIREA	–	IAc – water	–	–	–	–	–	Slight improvement. (52)
S. thunbergi	THUNBERG SPIREA	–	do.	–	–	–	–	–	Do.
Stephanandra flexuosa (S. incisa)	CUTLEAF STEPHANANDRA	July	IBc – water	10	6	3	88	88	(7)

+ Symbols: IAc – indoleacetic acid; IBc – indolebutyric acid; IPc – indolepropionic acid; NAc – naphthaleneacetic acid; NAd – naphthalene acetamide; NBc – naphthalenebutyric acid

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Stewartia pseudocamellia	JAPANESE STEWARTIA	July	IAc – water	100	24	6	50	33	(66)
Styrax japonica	JAPANESE SNOWBELL	July	IBc – water	50	4	3	100	10	Terminal buds forming when cuttings taken. (88)
Symphoricarpos albus laevigatus	COMMON GARDEN SNOWBERRY	Sept.	IAc – talc	1,000	–	6	74	54	Softwood cuttings. (33)
Symplocos paniculata	SAPPHIREBERRY SWEETLEAF	July	IAc – water	100	24	4	17	0	(66)
Syringa chinensis	CHINESE LILAC	–	IAc – lanolin	1,250	–	11	15	0	(52)
S. emodi	HIMALAYAN LILAC	Apr.	IBc – water	40	24	5	75	14	(47)
S. formosissima (S. wolfi)	WOLFS LILAC	July	IAc – water	50	48	10	33	0	(66)
S. henryi (S. villosa x S. josikaea)	HENRY LILAC								
	Lutece	May	IBc – water	40	24	3	100	25	(47)
S. japonica (S. amurensis var. japonica)	JAPANESE TREE LILAC	July	do.	22	20	–	0	0	Diluted Auxilin 3; leaf-bud cuttings. (55)
S. josikaea	HUNGARIAN LILAC	May	do.	40	24	5	75	25	(47)
S. meyeri	MEYER LILAC	July	do.	80	3	8	44	12	(7)
S. persica	PERSIAN LILAC	May	do.	40	24	5	100	0	(47)
S. prestoniae	PRESTON LILAC								
	Calphurnia	June	do.	80	24	6	80	20	(61)
Do.	Celia	June	do.	80	24	6	40	0	(61)
Do.	Charmiam	July	IAc – water	50	24	5	88	17	(66)
Do.	Jessica	June	IBc – water	80	24	6	20	0	(61)
Do.	Miranda	July	do.	40	24	7	60	20	(61)
Do.	Virgilia	June	do.	40	24	6	20	0	(61)
S. tomentella	FELTY LILAC	Apr.	do.	40	24	4	100	20	(47)
S. villosa	LATE LILAC	May	do.	40	24	3	75	0	(47)
Do.	do.	June	do.	50	6	7	72	80	(7)
S. vulgaris	COMMON LILAC	Mar.	IAc – water	200	23	3	33	–	Hardwood cuttings. (85)
Do.	do.	Mar.	do.	200	23	3	88	10	Softwood cuttings. (85)
Do.	Adelaide Dunbar	May	IBc – water	60	24	9	75	0	(47)
Do.	Antoine Buckner	May	IBc – water	20	24	9	75	0	(47)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65–68.

TABLE 3.-*Broadleaf Shrubs*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Syringa vulgaris	COMMON LILAC								
Do.	Arthur Wm. Paul	May	IBc - water	40	24	8	50	0	(47)
Do.	Belle de Nancy	July	IAc - water	200	24	5	43	17	(66)
Do.	Charles Joly	July	do.	100	24	10	80	0	(66)
Do.	do.	May	IBc - water	80	24	9	58*	0*	Diluted Hormodin A. (57)
Do.	Condorcet	July	IAc - water	100	24	10	75	20	(66)
Do.	Decaisne	May	IBc - water	60	24	8	100	0	(47)
Do.	Duc de Massa	Apr.	do.	40	24	11	75	0	(47)
Do.	Lonvois	May.	do.	50	-	9	49	41	Softwood cuttings; no advantage with hardwood cuttings. (88)
Do.	Maureen	June	do.	80	24	6	40	0	(61)
Do.	Mme. Casimir Perier	July	IAc - water	200	24	10	30	0	(66)
Do.	do.	May	IBc - water	60	24	7	50	0	(47)
Do.	Mme. Florent Stepman	May	do.	60	24	9	100	0	(47)
Do.	Mme. Lemoine	July	IAc - water	200	24	5	43	0	(66)
Do.	Mont Blanc	May	IBc - water	20	24	9	50	0	(47)
Do.	Muriel	June	do.	80	24	6	20	0	(61)
Do.	Peggy	June	do.	80	24	6	40	0	(88)
Do.	Perle von Teltow	May	do.	20	24	8	100	0	(47)
Do.	President Grevy	July	IAc - water	100	24	10	80	40	(66)
Do.	do.	June	IBc - water	30	6	7	32	24	(7)
Do.	President Poincare	May	do.	40	24	9	50	0	(47)
Do.	Professor Sargent	May	do.	60	24	8	75	0	(47)
Do.	Thunberg	June	do.	80	24	6	40	0	(61)
Do.	do.	July	do.	20	24	6	60	20	(61)
Tamarix gallica	FRENCH TAMARISK	-	IAc - water	-	-	-	-	-	Slight improvement. (52)
Teucrium chamaedrys	CHAMAEDRYS GERMANDER	Jan.	IBc - water	40	24	7	80*	30*	Diluted Hormodin A; also improved rooting of Oct. and Apr. cuttings. (57)
Do.	do.	Jan.	do.	80	24	5	100*	0*	Do.

+ Symbols: IAc - indoleacetic acid; IBc - indolebutyric acid; IPc - indolepropionic acid; NAc - naphthaleneacetic acid; NAd - naphthalene acetamide; NBc - naphthalenebutyric acid

TABLE 3.-*Broadleaf Shrubs*- Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Thea sp.	TEA	-	IAc - water	50	36	6	10	-	16-hour treatment ineffective. (23)
Do.	do.	-	do.	100	36	6	80	-	Lanolin paste ineffective. (23)
Thryallis sp.	-	-	-	-	-	-	-	-	See *Galphimia*.
Ugni molinae	CHILEGUAVA	Dec.	IAc - water	100	22	5	58	17	(43)
Vaccinium corymbosum	HIGH-BUSH BLUEBERRY	-	IAc or IPc - water	5-10	-	-	-	-	11 varieties tested; not advantageous. (10)
Do.	do.	-	Phenylacetic acid - water	25	-	-	-	-	Do.
Do.	do.	-	IBc - water	-	-	-	-	-	Diluted Auxilin 3; 11 varieties tested; not advantageous. (10)
Do.	do.	July	IAc - water	100	48	6	50	0	(66)
Do.	Rubel, Pioneer, Adams, and Cabot	Apr.	IBc - water	20-80	16-24	11	-	-	Diluted Hormodin A; not advantageous. (44)
Do.	do.	Apr.	do.	-	16	11	-	-	Diluted Auxilin 2, 3, 4; not advantageous. (44)
Vangueria edulis	VANGUERIA	-	IAc - water	100	22	-	-	-	Not advantageous. (43)
Veronica longifolia subsessilis	CLUMP SPEEDWELL	Oct.	IBc - water	20	24	3	60*	2*	Diluted Hormodin A; hardwood cuttings. (57)
Viburnum americanum [Auth or Mill.?]	VIBURNUM	Aug.	do.	100	24	5	92	88	(7)
V. carlesi	KOREANSPICE VIBURNUM	July	IAc - water	50	48	7	91	20	(66)
Do.	do.	June	IBc - water	30	6	2	64	15	(7)
V. cassinoides	WITHEROD VIBURNUM	June	do.	30-50	4	4	30	30	(88)
V. dentatum	ARROWWOOD VIBURNUM	June	do.	30	16	3	96	56	(7)
Do.	do.	Aug.	do.	10	24	5	95	30	(7)
Do.	do.	June	do.	30-50	4	6	100	80	Best results when actively growing wood used. (88)
V. dilatatum	LINDEN VIBURNUM	June	do.	30-100	2	4	100	70	Do.
V. lantana	WAYFARINGTREE VIBURNUM	-	IAc - water	-	-	-	-	-	Controls rooted better. (52)
Do.	do.	June	IBc - water	50	4	4	66	58	(88)
Do.	do.	July	do.	40	24	6	20	0	(60)
Do.	do.	July	do.	10	6	3	88	88	(7)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65-68.

TABLE 3.-*Broadleaf Shrubs*- Concluded

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Viburnum lentago	NANNYBERRY VIBURNUM	July	IBc - water	5-20	24	-	-	-	Not advantageous. (8)
V. opulus	EUROPEAN CRANBERRY-BUSH	June	do.	10	6	3	100	76	(7)
nana	do.	July	do.	30	5	4	100	96	(7)
V. plicatum	-	-	-	-	-	-	-	-	See *V. tomentosum*.
V. rhytidophyllum	LEATHERLEAF VIBURNUM	July	IBc - water	5-20	18	-	-	-	Not advantageous. (8)
V. sieboldi	SIEBOLD VIBURNUM	June	do.	30-50	4	4	92	0	(88)
Do.	do.	July	do.	10	24	4	84	48	(7)
V. tinus	LAURUSTINUS VIBURNUM	Dec.	IAc - water	50	6	2	100	30	Hastened rooting by approximately 2 weeks; more roots per cutting. (43)
V. tomentosum	VIBURNUM	July	IBc - water	30-50	20	-	33	0	(8)
Do.	do.	June	do.	30-50	4	4	91	92	(88)
Do.	do.	July	IAc - water	50	24	5	100	100	(66)
V. wrighti	WRIGHT VIBURNUM	June	IBc - water	30-100	4	4	100	59	(88)
Vitex agnuscastus	LILAC CHASTETREE	July	IAc - water	100	24	6	100	0	(66)
Do.	do.	Dec.	do.	100	22	3	92	75	Basal cuttings rooted best. (43)
V. negundo									
incisa	CUTLEAF CHASTETREE	July	IBc - water	20	24	3	64	4	(7)
Weigela sp.	-	-	-	-	-	-	-	-	See *Diervilla*.

+ Symbols: IAc - indoleacetic acid; IBc - indolebutyric acid; IPc - indolepropionic acid; NAc - naphthaleneacetic acid; NAd - naphthalene acetamide; NBc - naphthalenebutyric acid

TABLE 4.-*Herbaceous Plants*

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Acantholimon venustum	LARGEFLOWER PRICKLY-THRIFT	July, Aug.	IAc – water	100	18	5	–	–	Rooting delayed. (16)
Ageratum houstonianum	MEXICAN AGERATUM	Feb.	IBc – water	10	24	2	90*	26*	Diluted Hormodin A. (57)
Alternanthera versicolor	–	–	–	–	–	–	–	–	See *Telanthera versicolor.*
Antirrhium majus	COMMON SNAPDRAGON	Nov.	IBc – water	10	24	4	95*	47*	Diluted Hormodin A; results of Jan., Feb. and Apr. less satisfactory. (57)
Do.	do.	Mar.	do.	10	24	4	95*	62*	Do.
Begonia semperflorens	PERPETUAL BEGONIA	Jan.	do.	5	24	7	40*	27*	Diluted Hormodin A. (57)
Do.	do.	Feb.	do.	5	24	7	27*	27*	Do.
Bulbophyllum careyanum	ORCHID	Mar.	NAd – talc	–	–	8	60	60	Commercial preparation; bulbs treated with NAd + vitamin B_1 (5cc. of 1 ppm. applies weekly) rooted 100 percent. (17)
Centaurea gymnocarpa	VELVET CENTAUREA	Oct.	IBc – water	2.5	24	3	50*	7*	Diluted Hormodin A. (57)
Chrysanthemum frutescens	MARGUERITE CHRYSANTHEMUM	Dec.	do.	2.5	24	2	90*	27*	Do.
Do.	do.	Feb.	do.	2.5	24	2	66*	48*	Do.
Do.	do.	Feb.	do.	10	24	2	90*	48*	Do.
C. morifolium (C. hortorum)	FLORISTS CHRYSANTHEMUM	Nov.	do.	5	24	2	97*	22*	Do.
Do.	do.	Dec.	do.	5	24	3	83*	51*	Do.
Do.	do.	Dec.	do.	2.5	24	3	83*	51*	Do.
Do.	do.	Mar.	do.	2.5	24	3	90*	40*	Do.
Do.	Cora Peck Buehl	May	do.	2.5	24	2	83*	73*	Do.
Do.	Dr. Enguehard	Jan.	do.	5	24	2	87*	27*	Do.
Do.	Gold Lode	May	do.	2.5	24	2	75*	62*	Do.
Do.	do.	Jan.	do.	5	24	2	84*	51*	Do.
Do.	Legal Tender	May	do.	2.5	24	2	72*	6*	Do.
C. indicum	MOTHER CHRYSANTHEMUM	–	IAc – water	100–250	48–56	–	–	–	Greatly hastened rooting; more roots per cutting and stronger root system. (83)
Chrysanthemum sp.	CHRYSANTHEMUM	May	IAc – water	50–100	14	2	100	100	Treated cuttings averaged 30 roots, controls 2.5. (85)
Coleus blumei	COMMON COLEUS	–	do.	–	12–24	–	–	–	Advantageous; IAc alone better than 3 commercial products tried. (15)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65–68.

TABLE 4.-*Herbaceous Plants*—Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Cordyline stricta	AUSTRALIAN DRACENA	–	IAc – lanolin	612.5	–	5	88	38	(52)
Dahlia sp.	DAHLIA								
	Sagamore Gold	Apr.	NBc – talc	250–2,000	–	5	–	–	Not advantageous. (32)
Datura metel (D. cornucopia)	HINDU DATURA	Apr.	IAc – water	200	24	2	100	40	(85)
Dianthus caryophyllus	CARNATION; CLOVE PINK	Oct.	IBc – water	10	24	6	45*	37*	Diluted Hormodin A. (57)
Do.	do.	Oct.	do.	20	24	3	60*	30*	Dilnted Hormodin A; cuttings from older stem. (57)
Do.	do.	Nov.	do.	20	24	2	82*	10*	Dilnted Hormodin A; cuttings from young stem. (57)
Do.	do.	Dec.	do.	5	24	3	92*	32*	Diluted Hormodin A. (57)
Do.	do.	Jan.	do.	10	24	2	48*	0*	Do.
Do.	do.	Feb.	do.	20	24	3	82*	22*	Do.
Do.	do.	Mar.	do.	10	24	4	82*	57*	Do.
Do.	do.	Apr.	do.	10	24	1	57*	7*	20 p.p.m. injurious; dilnted Hormodin A. (57)
Do.	Achievement	–	do.	5	24	–	–	–	Treated cnttings rooted 2 days to 1 week earlier; percentage rooted nsnally higher. (46)
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
Do.	Claret	–	IBc – water	5	24	–	–	–	Do.
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
Do.	Dimity	–	IBc – water	5	24	–	–	–	Do.
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
Do.	Pelargonium	–	IBc – water	5	24	–	–	–	Do.
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
Do.	CARNATION								
	Puritan	–	IBc – water	5	24	–	–	–	Do.
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
Do.	Purity	–	IBc – water	5	24	–	–	–	Do.
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
Do.	Virginia	–	IBc – water	5	24	–	–	–	Do.
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.

+ Symbols: IAc – indoleacetic acid; IBc – indolebntyric acid; IPc – indolepropionic acid; NAc – naphthaleneacetic acid; NAd – naphthalene acetamide; NBc – naphthalenebutyric acid

TABLE 4.-*Herbaceous Plants*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Dianthus caryophyllus	CARNATION								
	Wivelsfield Crimson	–	IBc – water	5	24	–	–	–	Treated cuttings rooted 2 days to 1 week earlier; percentage rooted usually higher. (46)
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
Do.	Woburn	–	IBc – water	5	24	–	–	–	Do.
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Do.
Dianthus sp.	CALIFORNIA CARNATION	Sept.	IAc – water	25	2	3	100	40	More roots per cutting. (85)
Do.	ENGLISH CARNATION	Sept.	do.	25	2	3	90	0	(85)
Epidendrum radicans	ORCHID	Mar.	NAd – talc	–	–	8	100	0	Stem sections; vitamin B_1 applied weekly, 5 cc. of 1 p.p.m. (17)
Eupatorium riparium	RIVER EUPATORIUM	May	IBc – water	5	24	2	87*	85*	Diluted Hormodin A. (57)
Gentiana sino-ornata	CHINESE GENTIAN	Oct.	IAc – water	100	24	4	–	–	30 percent more cuttings rooted. (43)
Gypsophila paniculata	BABYSBREATH	July	do.	25	24	1	100	100	(81)
Hedysarum multijugum	MONGOLIAN SWEETVETCH	July	do.	100	24	4	20	0	(66)
Helichrysum rupestre DC. var. *helianthemifolium (Gnaphalium lanceolatum?)*	–	Dec.	do.	100	6	2	90	40	More roots per cutting. (66)
Hypericum sp.	ST. JOHN'S WORT	July	NAc – talc	1,000	–	3	95	43	(73)
Iberis sempervirens	EVERGREEN CANDYTUFT	–	IAc – water	100	–	4	53	31	(52)
Impatiens sp.	SNAPWEED; TOUCH-ME-NOT	Jan.	do.	200	24	3	100	0	(85)
Iresine herbsti	HERBST BLOODLEAF	Dec.	IBc – water	5	24	3	100*	72*	Diluted Hormodin A. (57)
Do.	do.	Feb.	do.	2.5	20	3	97*	90*	Diluted Hormodin A; 20-80 p.p.m. injurious. (57)
Do.	do.	Feb.	do.	5	24	4	52*	20*	Interuodal cuttings; diluted Hormodin A. (57)
Do.	do.	Feb.	do.	5	24	4	72*	65*	Diluted Hormodin A; leafless cuttings. (57)
I. lindeni Lem.	LINDEN BLOODLEAF	Feb.	NBc – talc	1,000	–	4	100	56	(31)
I. lindeni Van Houtte	do.	Dec.	IAc – water	50	5	1	100	100	Treated cuttings averaged twice as many roots. (43)
Kleinia neriifolia	KLEINIA	–	do.	100	22	–	–	–	Not advantageous. (43)
Lavandula officinalis (L. vera)	TRUE LAVENDER	–	do.	–	–	–	–	–	Slightly advantageous. (52)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65-68.

TABLE 4.-*Herbaceous Plants*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Linum flavum	GOLDEN FLAX	Oct.	IBc - water	10;20	24	3	5*	7*	Diluted Hormodin A; matured stem. (57)
Lithodora diffusa (Lithospermum prostratum)	ACIDSOIL LITHODORA	Jan.	IAc - water	25	24	4	-	-	20 percent more treated cuttings rooted; more roots per cutting. (81)
Do.	do.	Jan.	do.	100	48	4	-	-	Do.
Maxillaria variabilis	ORCHID	Mar.	NAd - talc	-	-	8	70	40	Commercial preparation; black bulbs; 100 percent rooted when vitamin B_1 added weekly (5 cc. of 1 p.p.m.) (17)
lutea	do.	Mar.	do.	-	-	8	100	30	Commercial preparation; black bulbs; vitamin B_1 added weekly (5 cc. of 1 p.p.m.); 60 percent rooted with vitamin B_1 alone. (17)
Medicago sativa	ALFALFA	Nov.	IBc - water	2.5	24	4	82*	12*	Diluted Hormodin A. (57)
Do.	do.	Nov.	do.	10	24	4	72*	37*	Do.
Do.	do.	-	IAc - water	-	12-24	-	-	-	Advantageous; IAc alone better than 3 commercial preparations tried. (15)
Megaclinium purpureum	ORCHID	Mar.	NAd - talc	-	-	8	80	60	Commercial preparation; black bulbs; weekly addition of 5 cc. of 1 p.p.m. vitamin B_1 caused 100 percent rooting. (17)
Mesembryanthemum roseum	ROSE FIGMARIGOLD	Feb.	IBc - water	5	24	3	95*	80*	Diluted Hormodin A; mature stem best. (57)
Monarda didyma	OSWEGO BEEBALM	Oct.	do.	20	24	3	80*	22*	Diluted Hormodin A; terminal young stem. (57)
Do.	do.	Oct.	do.	20	24	3	32*	2*	Diluted Hormodin A; mature stem. (57)
Pachysandra terminalis	JAPANESE PACHYSANDRA	Nov., Dec.	NAc - water	20-100	24	4	-	-	Treated plants rooted at nodes and internodes, controls at nodes only. (41)
Do.	do.	Nov., Dec.	IBc - water	20-100	24	4	-	-	Do.
Do.	do.	Nov., Dec.	IAc - water	40-200	24	4	-	-	Do.
Do.	do.	-	IBc - water	80	24	-	-	-	Advantageous. (49)
Do.	do.	-	IBc - talc	12,000	-	-	-	-	Do.
Do.	do.	June	IBc - water	30	6	4	100	60	(7)
Pelargonium domesticum	LADY WASHINGTON PELARGONIUM	Feb.	do.	10	24	5	62*	10*	Diluted Hormodin A. (57)

+ Symbols: IAc - indoleacetic acid; IBc - indolebutyric acid; IPc - indolepropionic acid; NAc - naphthaleneacetic acid; NAd - naphthalene acetamide; NBc - naphthalenebutyric acid

TABLE 4.-*Herbaceous Plants*-Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Pelargonium domesticum	LADY WASHINGTON PELARGONIUM	June	IBc – water	10	24	4	53*	25*	Diluted Hormodin A. (57)
P. hortorum	FISH PELARGONIUM								
Do.	Mrs. Beach	June	do.	5	24	3	80*	2*	Do.
Do.	Mrs. Waters	June	do.	5	24	3	94*	5*	Do.
Do.	Mt. Mort	June	do.	10	24	3	72*	15*	Do.
Do.	S. A. Nutt	June	do.	5	24	3	75*	2*	Do.
Do.	Riccard	June	do.	5	24	3	62*	12*	Do.
P. peltatum	IVYVINE PELARGONIUM	Feb.	do.	10	24	2	100*	15*	Do.
Do.	do.	June	do.	10	24	3	80*	30*	Do.
P. tricolor	PELARGONIUM	Jan.	do.	2.5	24	6	87*	22*	Do.
[*Pelargonium* sp.?]	GERANIUM	Aug.	IAc – water	50	15	6	100	100	Twice as many roots per cutting. (85)
Penstemon barbatus	BEARDLIP PENSTEMON	Oct.	IBc – water	10	24	4	65*	2*	Diluted Hormodin A. (57)
Petunia hybrida	COMMON PETUNIA	Apr.	do.	10	24	3	72*	45*	Do.
Phleum pratense	TIMOTHY	Mar.	NAc – charcoal	10,000	–	4	83	33	(60)
Phlox paniculata	SUMMER PHLOX	Oct.	IBc – water	5	24	3	52*	49*	Diluted Hormodin A. (57)
Do.	do.	Oct.	do.	20	24	3	75*	49*	Do.
P. subulata	MOSS PINK								
	Lavinia	June	IAc – water	50	24	2	–	–	20 percent more cuttings rooted. (81)
Pilea microphylla	ARTILLERY CLEARWEED	Jan.	IBc – water	5	24	5	67*	42*	Dilnted Hormodin A. (57)
Piqueria trinervia	FRAGRANT PIQUERIA	Mar.	IBc – water	10	24	3	93*	–	Diluted Hormodin A. (57)
Do.	do.	May	do.	5	24	2	90*	57*	Do.
Polygonum paniculatum	POLYGONUM	July	do.	16.6	24	–	10	0	(81)
Do.	do.	July	NAc – water	33.3	24	–	10	–	(81)
Saintpaulia sp.	AFRICANVIOLET	Feb.	IAc – water	50	16	3	100	100	More roots per cutting. (85)
Salvia apiana	WHITE SAGE	Mar.	do.	200	36	3	100	0	(85)
S. mellifera	BLACK SAGE	Feb.	do.	200	24	2	100	0	(85)
Do.	–	Mar.	do.	200	24	3	100	63	(85)
Sansevieria guineensis	BOWSTRING HEMP	Nov.	IAc – lanolin	5,000	–	6	76	12	(52)
Telanthera versicolor	COPPER ALTERNANTHERA	Oct.	IBc – water	2.5	24	3	97*	80*	Diluted Hormodin A. (57)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.
§ Numbers in parentheses refer to literature citations, pp. 65–68.

TABLE 4.-*Herbaceous Plants*-Concluded

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Tradescantia sp.	SPIDERWORT	–	IAc – lanolin	500	–	3	–	0	Leafless cuttings; applied 10 mg. per treatment; treated cuttings averaged 6.3 roots per cutting. (11)
Trifolium pratense	RED CLOVER	Mar.	NAc – water	10	12	3	–	–	Also recommended 50 p.p.m. in talc, and 10 p.p.m. in nutrient solution. (60)
Verbena hybrida	COMMON GARDEN VERBENA	Oct.	IBc – water	5	24	1	32*	0*	Diluted Hormodin A. (57)
Do.	do.	Oct.	do.	5	24	1	65*	5*	Do.
V. laciniata (V. erinoides)	MOSS VERBENA	Oct.	do.	10	24	2	80*	37*	Do.
V. rigida (V. venosa)	VERBENA	Oct.	do.	5	24	2	89*	32*	Do.
Viola cornuta	HORNED VIOLET; BEDDING PANSY	July	do.	8.33	24	2	–	–	30 percent more rooted. (81)
Do.	do.	July	NAc – water	25	24	2	–	–	Do.
Do.	do.	July	IAc – water	25	24	2	–	–	Do.

TABLE 5.-*Climbing and Trailing Plants*

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Actinidia arguta	BOWER ACTINIDIA	June	NAc – talc	1,000	–	2	88	38	(73)
Allamanda cathartica	COMMON ALLAMANDA	Feb.	IBc – water	20	24	8	72*	47*	Diluted Hormodin A. (57)
Do.	do.	Nov.	do.	20	24	7	65*	2*	Do.
Ampelopsis tricuspidata	–	–	–	–	–	–	–	–	See *Parthenocissus tricuspidata.*
Arctostaphylos uva-ursi	BEARBERRY	July	IBc – water	5–20	24	–	–	–	Not advantageous. (8)
Do.	do.	–	do.	40	24	–	–	–	Advantageous. (49)
Do.	do.	–	IBc – talc	12,000	–	–	–	–	Do.
Do.	do.	Feb.	IBc – water	20–40	24;43	–	80–100	–	Terminals, and lateral heel cuttings. (18)
Artostaphylos sp.	–	–	–	–	–	–	–	–	See also table 3.
Aristolochia durior (A. sipho, A. macrophylla)	COMMON DUTCHMANSPIPE	July	IAc – water	200	24	4	40	0	(66)
Bougainvillea glabra	LESSER BOUGINVILLEA	Nov.	IBc – water	20	24	7	62*	7*	Diluted Hormodin A. (57)

+ Symbols: IAc – indoleacetic acid; IBc – indolebutyric acid; IPc – indolepropionic acid; NAc – naphthaleneacetic acid; NAd – naphthalene acetamide; NBc – naphthalenebutyric acid

TABLE 5.-*Climbing and Trailing Plants*—Continued

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Bougainvillea spectabilis	BRAZIL BOUGINVILLEA								
	Crimson Lake	–	IAc – lanolin	5,000	–	7	35	0	(52)
Campsis radicans	COMMON TRUMPET-CREEPER	–	IAc – water	–	–	–	–	–	Slight advantage. (52)
Do.	do.	July	do.	100	24	4	100	100	(66)
Celastrus scandens	AMERICAN BITTER-SWEET	July	IBc – water	50	20	5	90	0	Taken from actively growing vines. (88)
Do.	do.	July	do.	30	6	7	100	0	(8)
Cerastium tomentosum	SNOW-IN-SUMMER	Nov.	do.	10	24	3	67*	12*	Diluted Hormodin A. (57)
Cissus rhombifolia	VENEZUELA TREEBINE	Feb.	do.	10	24	5	90*	10*	Do.
Clematis paniculata	SWEETAUTUMN CLEMATIS	July	do.	10	24	4	75*	3*	Do.
Do.	do.	Oct.	do.	20	24	6	60*	5*	Do.
Gaultheria procumbens	WINTERGREEN CHECKERBERRY	Mar.	IAc – water	100	24	–	–	–	35 percent more cuttings rooted. (81)
Do.	do.	Mar.	NAc – water	100	24	–	–	–	51 percent more cuttings rooted. (81)
Hedera helix	ENGLISH IVY	July	IBc – water	30	4	2	100	96	(7)
Do.	do.	Jan.	NAc – water	100	24	4	100	0	(81)
Do.	do.	Jan.	IAc – water	100	24	4	100	0	(81)
Do.	do.	–	IBc – talc	2,000	–	–	–	–	Advantageous. (49)
Humulus lupulus	COMMON HOP								
	Brewers Gold	Summer	Phenylacetic acid – water	–	24	2	0	0	Lateral branches. (3)
Do.	do.	Apr.	do.	–	–	–	80	50	(3)
Do.	do.	June	IAc – water	100	24	–	80	0	(3)
Do.	do.	Apr.	do.	200	24	–	100	50	(3)
Do.	do.	Summer	NAc – water	50	24	2	80	0	Lateral branches. (3)
Hydrangea petiolaris (H. scandens)	CLIMBING HYDRANGEA	July	IBc – water	30	22	9	16	0	(8)
Do.	do.	July	IAc – water	200	24	6	60	60	(66)
Hydrangea spp.	–	–	–	–	–	–	–	–	See also table 3.
Lonicera japonica	JAPANESE HONEYSUCKLE								(57)
articulata		Jan.	IBc – water	2.5	24	6	77*	–	Diluted Hormodin A; over 10 p.p.m. injurious; fine sand rooting medium. (57)
Do.	do.	Jan.	do.	5	24	5	75*	2*	Do.
Lonicera spp.	–	–	–	–	–	–	–	–	See also table 3.
Parthenocissus tricuspidata	JAPANESE CREEPER; BOSTON IVY	July	IBc – water	20	24	6	42*	5*	Diluted Hormodin A. (57)
Do.	do.	Aug.	do.	30	24	3	90	90	(7)
Pereskia sacha-rosa	PERESKIA	–	IAc – water	–	12–24	–	–	–	Advantageous; IAc alone better than 3 commercial preparations tried. (15)

* Numbers marked with an asterisk are grades based on number rooted, number of roots per cutting, and length of roots.

§ Numbers in parentheses refer to literature citations, pp. 65–68.

TABLE 5.-*Climbing and Trailing Plants*-Concluded

SCIENTIFIC NAME	COMMON NAME AND HORTICULTURAL VARIETIES	MONTH OR SEASON	TREATMENT			ROOTING TIME	PERCENTAGE ROOTED		REMARKS §
			PREPARATION USED +	CONCENTRATION	TIME		TREATED	CONTROL	
				p.p.m.	*Hours*	*Weeks*			
Pueraria hirsuta (P. thunbergiana)	THUNBERG KUDZUBEAN	Oct.	Commercial Preparations	–	–	2	60–85	42–51	Advantageous; potassium permanganate better than hormones. (59)
Rosa spp.	–	–	–	–	–	–	–	–	See table 3.
Senecio mikanioides	GERMAN IVY; IVY GROUNDSEL	Jan.	IBc – water	5	24	4	85*	67*	Diluted Hormodin A. (57)
Do.	do.	Jan.	do.	2.5	24	2	95*	45*	Do.
Senecio spp.	–	–	–	–	–	–	–	–	See also table 3.
Tecoma radicans	–	–	–	–	–	–	–	–	See *Campsis radicans*.
Thunbergia sp.	CLOCKVINE	–	IAc – water	–	12–24	–	–	–	Advantageous; IAc alone better than 3 commercial preparations tried. (15)
Vinca minor	COMMON PERIWINKLE	Aug.	IBc – water	10	24	3	100	84	(7)
Vitis rotundifolia	MUSCADINE GRAPE	Aug.	do.	20	20	3	44	0	Best to use cuttings from third to sixth node back from growing tip. (88)
Vitis vinifera	EUROPEAN GRAPE; WINE GRAPE								
	Berlaudieri 41B	Mar.	IAc – lanolin	–	–	6	55	0	1.6 mg. IAc applied on basal cut surface. (24)
Do.	do.	Mar.	IAc – water	150	44	6	80	0	(24)
Do.	Chasselas	Mar.	do.	–	–	8	100	100	Crystals applied to apical cut surface. (24)
Do.	Concord	Mar.	do.	100	24	5	100	100	More roots per cutting. (85)
Do.	Empress	Mar.	do.	200	24	5	100	100	Do.
Do.	Hamburger Muskat	Feb.	IAc – lanolin	–	–	3	100	0	1.2 mg. IAc applied on apical cut surface. (24)
Do.	Mourvedre x Rupestris 1202	Mar.	do.	–	–	6	100	75	1.6 mg. IAc applied on basal cut surface. (24)
Do.	Rupestris 1202	Mar.	IAc – water	150	44	6	100	80	(24)
Do.	Rupestris du Lot	Mar.	IAc – lanolin	–	–	6	80	15	1.6 mg. IAc applied on basal cut surface. (24)
Do.	Thompson	Mar.	IAc – water	200	24	4	100	70	More roots per cutting. (85)
Vitis sp.	–	–	–	–	–	–	–	–	See also *Cissus*.
Wistaria sinensis	CHINESE WISTARIA	July	IAc – water	100	12	4	100	0	(54)
albiflora	WHITE CHINESE WISTARIA	July	do.	200	24	9	70	9	(66)
Do.	do.	May	do.	200	24	3	100	0	(85)

+ Symbols: IAc – indoleacetic acid; IBc – indolebutyric acid; IPc – indolepropionic acid; NAc – naphthaleneacetic acid; NAd – naphthalene acetamide; NBc – naphthalenebutyric acid

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